

# Polikarpov Fighters

## in action Pt. 2



Aircraft Number 162  
squadron/signal publications



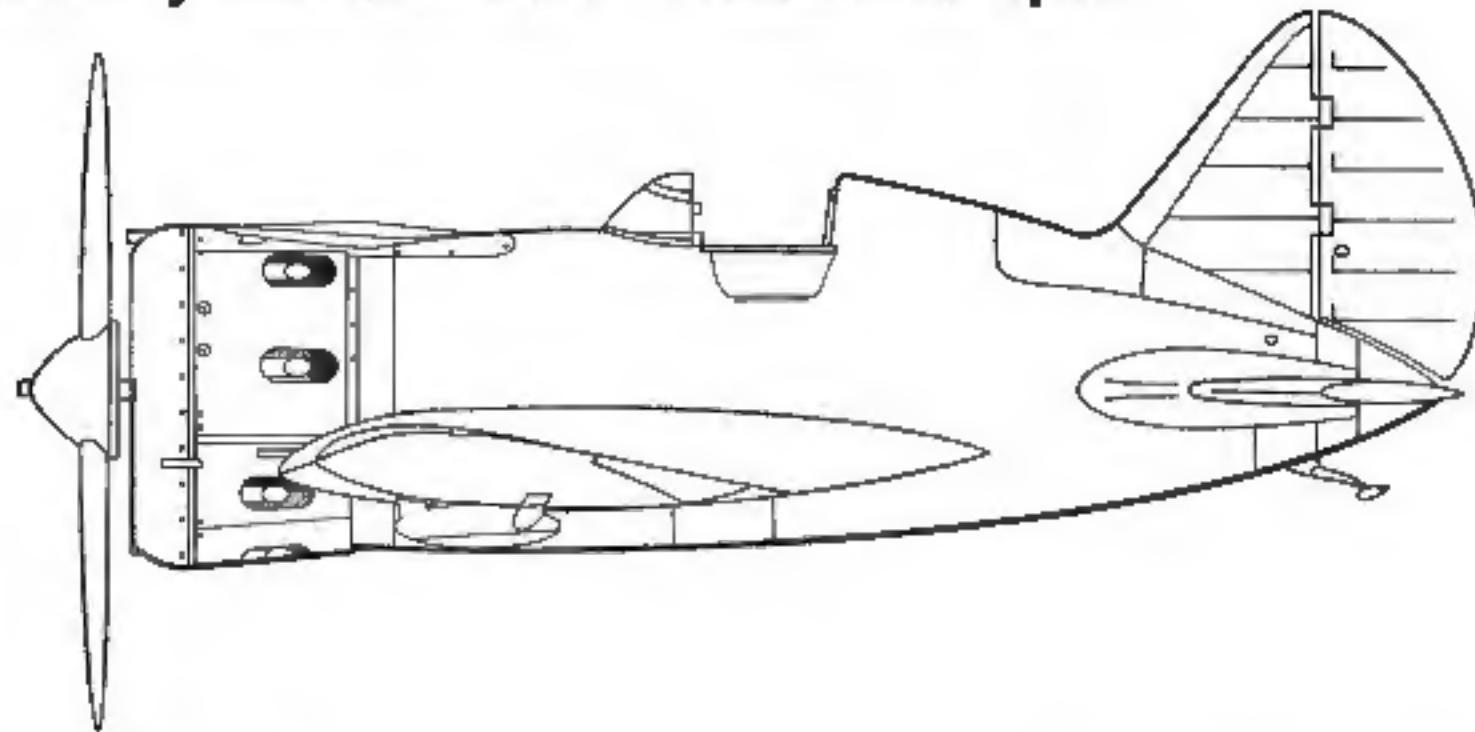
# **Polikarpov Fighters**

**By Hans-Heiri Stapfer**

**Color by Don Greer**

**Illustrated by Joe Sewell & Ernesto Cumpian**

**in action Pt II**



**Aircraft Number 162**

**squadron/signal publications**



A pair of I-16s scramble to take off while under attack from Luftwaffe Bf-109s. During the opening phase of the invasion of the Soviet Union, large numbers of I-16s were caught on the ground and destroyed.

## Acknowledgements

Ivan Ivanov

Mariusz Zimny

Klaus Niska

Bundesarchiv Koblenz

Museo del Aire - Madrid

Dr. Volker Koos

Ödön Horvath

Keski-Suomen Ilmailumuseo

Nigel A. Eastaway

Hadtorteneti Muzeum

G. F. Petrov

Dave Hatherell

Andrew Zinchuk

Dan Antonius

Christoph Stuker

B. Rawolle

Mihai Moisescu

Robert Bock

Hannu Valtonen

Andrzej Morgala

Heinz J. Nowarra

Justo Miranda

E.C.P.A.

Martin Kyburz

Hans-Joachim Mau

Wolfgang Tamme

V. Simecek

Zdenek Hurt

Dusan Mikolas

Martin Dorsky

Andras Nagy

Frieder Voigt

Carlo Lucchini

Nicholas J. Waters III

Robert Gretzyngier

A. A. Zimov

Yefim Gordon

Angelo Gentina

Juan Arraez Cerdá

Heinz Birkholz

Marc Bressan

George Punka

Attila Bonhardt

Ivo Zetik

Harold Thiele

James V. Crow

Bernard Denes

Ronald Gravel

Günter Metzner

Thomas Heinicke

R.A. R.T.

## Dedication:

This book is dedicated to Dusan Mikolas, the winner of our little Vodka drinking competition in Prague. Dusan was right in saying, "To make counting easier, in our next contest, lets not count empty glasses, lets count empty bottles."

I would also like to dedicate this book to my long time friend, Zdenek Hurt and his mother, as well as all the other fine people I met in the capital of the Czech Republic.

COPYRIGHT 1996 SQUADRON/SIGNAL PUBLICATIONS, INC.

1115 CROWLEY DRIVE CARROLLTON, TEXAS 75011-5010

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form by means electrical, mechanical or otherwise, without written permission of the publisher.

ISBN 0-89747-355-8

If you have any photographs of aircraft, armor, soldiers or ships of any nation, particularly wartime snapshots, why not share them with us and help make Squadron/Signal's books all the more interesting and complete in the future. Any photograph sent to us will be copied and the original returned. The donor will be fully credited for any photos used. Please send them to:

Squadron/Signal Publications, Inc.

1115 Crowley Drive

Carrollton, TX 75011-5010

Если у вас есть фотографии самолетов, вооружения, солдат или кораблей любой страны, особенно, снимки времен войны, поделитесь с нами и помогите сделать новые книги издательства Эскадрон/Сигнал еще интереснее. Мы переснимем ваши фотографии и вернем оригиналы. Имена приславших снимки будут сопровождать все опубликованные фотографии.

Пожалуйста, прсылайте фотографии по адресу:

Squadron/Signal Publications, Inc.

1115 Crowley Drive

Carrollton, TX 75011-5010

軍用機、装甲車両、兵士、軍艦などの写真を所持しておられる方はいらっしゃいませんか？どの国ものでも結構です。作戦中に撮影されたものが特に良いのです。Squadron/Signal社の出版する刊行物において、このような写真は内容を一層充実し、興味深くすることができます。当方にお送り頂いた写真は、複写の後お返しいたします。出版物中に写真を使用した場合は、必ず提供者のお名前を明記させて頂きます。お写真は下記にご送付ください。

Squadron/Signal Publications, Inc.

1115 Crowley Drive

Carrollton, TX 75011-5010

A line-up of Polikarpov I-16 Type 24s and cannon armed Type 27s. Each of the fighters carries a different camouflage pattern, although the colors are standard, Olive Green and Dark Green over Light Blue undersurfaces. (G. F. Petrov)

# Two Seat Trainers

## UTI-2 Trainer

In July of 1935, the I-16 Type 4 fighter was assigned to front-line Fighter Aviation Regiments. Simultaneously, it was decided to develop a two seat trainer version of the I-16 to assist pilots in conversion from earlier biplane fighters to the new monoplane. The flight characteristics of the I-16 were demanding and it soon became obvious that novice pilots needed at least a couple of familiarization flights in a training version. When young pilots transitioned from the Polikarpov U-2 biplane directly to the hot monoplane I-16 the attrition rate, especially during take offs and landings was quite high.

During 1936, the first series of UTI-2 (*UTI=Uchebno Trenirovochny Istrebitel/Fighter Trainer*) trainers were produced. The UTI-2 was based on the I-16 Type 4 with a second rear cockpit for the instructor and dual controls. The aircraft was unarmed and was powered by an 480 hp M-22 power plant. UTI-2s were produced in very limited numbers, mainly due to the fact that the more powerful M-25 engine had become available.

The introduction of the I-16 had revealed that the Polikarpov U-2 was no longer suited for basic training, since many novice pilots had great difficulty in mastering the I-16 after receiving their initial training in the Polikarpov biplane. As a result, a two seat low wing training monoplane, the Yakovlev UT-2, was chosen as the primary trainer and the UT-1 single seat aerobatic trainer, which had flight characteristics close to the I-16, for advanced training. Then fighter pilots would receive their conversion training in the UTI-2 and later UTI-4, before finally progressing to the single seat I-16 fighter.

## UTI-4 Trainer

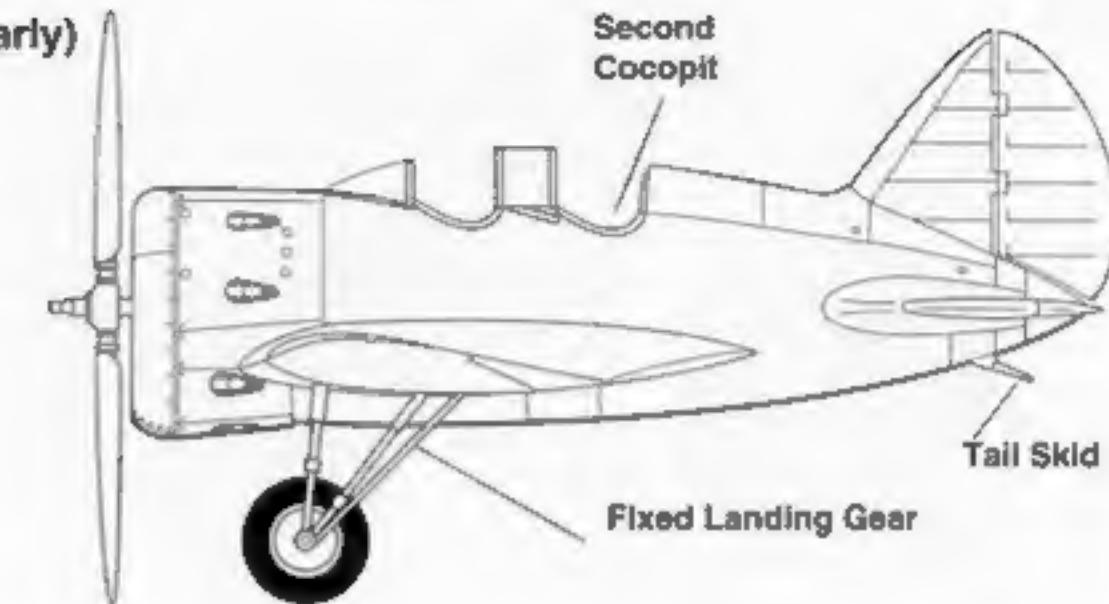
During 1937, the first UTI-4 two seat trainers were delivered to the Fighter Aviation Regiments. Once UTI-4 production was launched, an order was issued by the Ministry of Aviation Production, that every fourth airframe on the I-16 production line should be completed as a trainer. The UTI-4 differed from the earlier UTI-2, in that it was based on the I-16 Type 5 airframe with a M-25 power plant.

**An UTI-4, Yellow 5, on final approach for landing. The White fuselage band indicates that this aircraft is restricted from aerobatic flight. This restriction was due to the age of the airframe. (Yefim Gordon)**

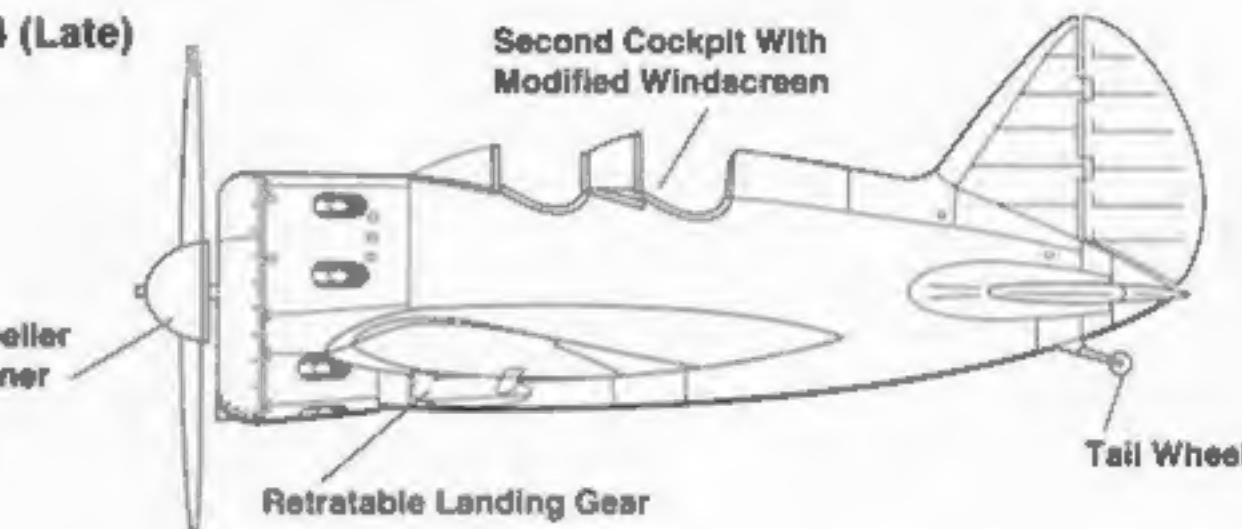


## Trainer Development

UTI-4 (Early)



UTI-4 (Late)



ed as a trainer. The UTI-4 differed from the earlier UTI-2, in that it was based on the I-16 Type 5 airframe with a M-25 power plant.

The UTI-4, like the earlier UTI-2, carried no armament in order to save weight due to the introduction of the second cockpit. Normally, the instructor would occupy the rear cockpit, while the student usually occupied the front cockpit. The standard cockpit was moved to the rear some seventeen inches (45 cm) and the fuel tank was recontoured and reduced in size to enable the second cockpit to be installed in the fuselage.

The cockpit entry door was deleted on the UTI-4. While the fighter had a straight cockpit, A new, flatter single piece windscreens was installed in front of the front cockpit and a second, smaller 'tunnel shaped' windshield was installed between the front and the rear cockpits.

Early UTI-4s were all fitted with the M-25 power plant, but when the M-25A became available, it was also installed in the UTI-4. A number of early UTI-4s also lacked a propeller spinner, however, this was not an identification feature, since a number of early UTI-4s did carry a spinner.

Early UTI-4s had a 'tunnel' shaped rear windscreens but, in order to improve the view out the front from the rear cockpit, the padded head rest in the front cockpit was lowered and a flatter,

sloped frameless windshield was fitted on later production versions.

The two seat fighter-trainer was progressively developed along side the fighter series. The only exception was that the UTI-4 retained the large wing flaps, which were standard to the early fighter versions I-16 Type 5 and I-16 Type 6, throughout its production life. As production proceeded, most of the improvements introduced on the fighters were also automatically introduced on the trainer, such as improved instrumentation and cable cutter for the main undercarriage.

When the I-16 Type 10 became available with its M-25V power plant, this same engine was also fitted to the UTI-4. The first UTI-4 with the new engine left the production line at GAZ-21 and GAZ-153 during 1938. These M-25V powered trainers had also a T-shaped air intake on the lower engine cowl lip. While the early UTI-4 had a single exhaust stack in the lower exhaust port, M-25V powered UTI-4 had two exhaust stacks in the lower port. Most of the standard production UTI-4s powered by the M-25V engine were equipped with an I-16 Type 5 propeller spinner.

A number of UTI-4s were fitted with a fixed undercarriage and, as a result, no landing gear strut and wheel covers were installed.

Late production UTI-4s had the tailskid replaced by a tailwheel. Due to shortage of trainer versions of modern fighters, such as the Yak-1 and the LaGG-3, the UTI-4 also served as a transition trainer for young pilots slated to fly these fighters. In the early stage of the Great Patriotic War, the UTI-4 also served in the reconnaissance role over the front. A number of UTI-4s were also assigned to Fighter Aviation Regiments at the front for liaison duties. Even in 1944, when all I-16 had been withdrawn from active duty, the UTI-4 soldiered on.

A number of UTI-4s were also converted with fixed ski landing gear. As a result the main wheel covers were deleted and cables were attached to front and rear of the skis to keep them from moving in flight. A small ski was also attached to the tailskid.

The UTI-4 also saw service as a blind flying trainer. Initially a fabric, folding tent was installed in the rear cockpit which was closed just before take off. Other UTI-4s converted for this duty were fitted with a rear sliding plywood hood. Some UTI-4s were also equipped with a rudder trim tab and some late production UTI-4s were fitted with a tailwheel replacing the tailskid. UTI-4s serving in the blind flying training role were still in use during 1943.

Between 1937 and mid-1939, a total of 1,639 UTI-2 and UTI-4 trainers were built at GAZ-21, GAZ-153 and GAZ-458 (which solely produced UTI-4s). UTI-4s, which during the final stages of their use, were prohibited from performing aerobatics, carried either a White Cyrillic 'N' or a White band on the fuselage to plainly identify them as restricted use aircraft.



This colorful UTI-4 served as a trainer with the 2nd Guards Fighter Aviation Regiment in the Murmansk area in the Summer of 1942. The aircraft carried the Red star on the fuselage, fin and both upper and lower wing surfaces. (G. F. Petrov)

21, GAZ-153 and GAZ-458 (which solely produced UTI-4s). UTI-4s, which during the final stages of their use, were prohibited from performing aerobatics, carried either a White Cyrillic 'N' or a White band on the fuselage to plainly identify them as restricted use aircraft.

## Spanish UTI-4

UTI-4s were delivered to Spain with the aim to converting non-Soviet personnel to the I-16. In contrast to the biplane I-15, the flying characteristics of the I-16 were, as the Spanish and foreign pilots quickly found out, far more demanding. On 8 July 1937, four UTI-4 two seat trainers arrived in Spain aboard the freighter CABO SANTO TOME. These trainers were among the first UTI-4s produced in the Soviet Union. They were all equipped with the M-25 power plant and were the only trainers delivered to Spain during the civil war.

Most of the training bases of the *Fuerza Aerea Republicana* (FARE) were located in the province of Murcia in South-Eastern Spain. All four UTI-4s were allocated to the high speed fighter training camp at El Carmoli near Cartagena. This unit was supplemented by a number of older I-16 Type 5s and I-16 Type 6s single seat fighters.

A group of Spanish pilots pose with one of four early production UTI-4s delivered to Spain at El Carmoli Airfield during 1938. (Juan Arreaz Cerda)



the propeller arc. During the initial stages of the flight test program, no armament was carried and dummy barrels were installed in the wings.

In late November of 1933, a full scale mock-up was built. The projected performance figures for the TsKB-12 were so promising, that, even before the first prototype had been completed, the question of placing the fighter into production was raised.

The M-22 powered TsKB-12 was rolled out of the factory on 28 December 1933 and flew for the first time on 30 December, with Valeri F. Chkalov at the controls. A day later the factory test program was started.

The TsKB-12 prototype was equipped with a fixed ski landing gear, although this was a temporary feature needed because of the harsh winter weather. In its original configuration, the TsKB-12 was equipped with a small rudder, but early factory tests soon revealed that the stability was less than satisfactory and the rudder area was enlarged. Additionally, the three blade Hamilton-Standard propeller was replaced by a two blade Soviet V-22 propeller, while the Wright-Cyclone powered TsKB-12bis retained the three blade Hamilton-Standard propeller.

During early 1934, while still undergoing factory tests, the engine cowling of the TsKB-12 was modified to overcome problems with engine overheating. The new cowling was more tapered and the front face was enlarged with the cylinder fairings being deleted. Additionally, two air intakes were installed on top of the engine cowling.

The TsKB-12bis prototype, powered by a Wright-Cyclone SGR-1820-F-2 power plant (because the intended SGR-1820-F-3 was unavailable) made its first flight during January of 1934. The TsKB-12bis prototype differed from the TsKB-12 primarily in having a larger cowling. Factory tests for both aircraft were conducted by Valeri F. Chkalov.

Despite the various shortcomings detected in the TsKB-12 and TsKB-12bis prototypes, which were not fully corrected, both prototypes were transferred to the Scientific Test Institute of the Red Air Force (NII-VVS) for State Acceptance Trials. The acceptance program, which lasted from 16 to 27 February 1934, was conducted by test pilots V.K. Kokkinaki for the TsKB-12 and V.A. Stepanchonok for the TsKB-12bis.

Due to the winter weather, the test program had to be performed with fixed ski landing gear on both aircraft but, even with the extra drag, the performance of the new fighter was impressive. The TsKB-12 reached 190 mph (306 km/h) at sea level, while the TsKB-12bis reached a speed of 218 mph (351 km/h). Both test pilots praised the simple controls of the aircraft and its maneuverability, the TsKB-12 needed only 15.5 seconds to complete a 360 degree turn. On the other hand, the aircraft was very unstable at high speeds which made handling of the aircraft very difficult. Both test pilots pointed out that only pilots with considerable skill could be entrusted with the new fighter.

In the meantime, the Red Air Force, despite the various shortcomings of the type, showed a great interest in adding the TsKB-12 to the inventory as soon as possible and negotiations with the Central Department of the Aircraft Industry were started.

After the end of the trials, both prototypes were returned to the factory to improve the weak points of the fighters detected during the trials. The list of complaints in the reports were long and included engine overheating, poor handling characteristics at high speed and insecure mountings for the wing guns. The Polikarpov OKB went to work to solve these problems through engineering improvements.

In April of 1934, the State Acceptance Trials were resumed. Due to more favorable weather conditions, the ski-landing gear was replaced by the a retractable wheel landing gear. Due to the fact that all flights were performed with the canopy in the open position, the port entrance



The TsKB-12bis prototype was damaged during a crash landing when the landing gear failed. The aircraft was powered by a Wright-Cyclone SGR-1820-F-2 engine instead of the intended SGR-1820-F-3 because the F-3 engine had not arrived in time. (A.A. Zirnov) door was removed, allowing for a quicker bail out in the event of an emergency. During a part of the test program, the OP-1 gunsight was also removed, but was reinstalled when armament trials were performed.

The test flights of both prototypes soon revealed that a number of problems remained, especially with the landing gear, which had to be cranked up and down manually. During ground tests the landing gear retracting mechanism worked properly but, in the air the device often experienced problems. Sometimes, the landing gear could only be fully lowered after performing a high G maneuver.

Instability during climb and in turns demanded a high degree of concentration on the part of the pilot and the rigidly-mounted engine produced an annoyingly high vibration level. The handcrank operating the landing gear retraction became progressively stiffer as the wheels came up, often resulting in an undulating climb-out since it was difficult not to transmit the cranking motion from one hand to the other holding the control column. The landing gear also tended to stick in a partly-retracted position.

During the State Acceptance trials, the TsKB-12bis suffered a crash landing due to a failed landing gear and, even after some redesign, it still had some flaws. There were also a number of problems with the TsKB-12, such as a slackening of the wing's linen covering, especially in the center section. It was determined at the conclusion of the tests that, both the TsKB-12 and TsKB-12bis were not ready for production.

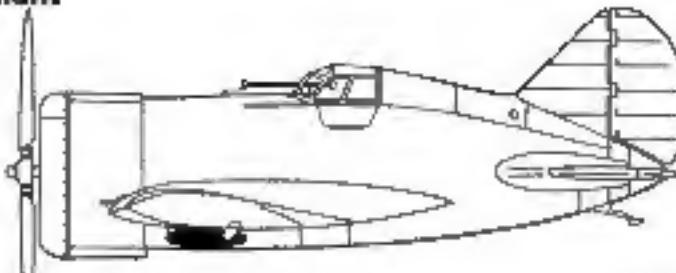
The TsKB-12 was returned to the factory to rectify its problem areas and, in September of 1934, both TsKB-12 and the repaired TsKB-12bis, which had been re-engined with a Wright-Cyclone SGR-1820-F-3 engine, were transferred for the third time to NII-VVS, where trials were started once more. During modernization a number of improvements were made by the designers. The covering of the center wing section and wing leading edge was now metal, allowing the wing to maintain its proper shape at a wide range of speeds and wing loading. The TsKB-12bis prototype had the three blade Hamilton-Standard propeller, replaced by two blade propeller.

During this flight test program, the TsKB-12 reached 202 mph (325 km/h) at 16,404 feet (5,000 meters), climbed at 1,745 feet per minute, and reached a ceiling of 23,556 feet (7,180 meters). These figures were considerably lower than that of the Wright-Cyclone powered TsKB-12bis, which reached 256 mph (413 km/h) at 16,404 feet with a rate of climb of 2,645 feet per minute and a ceiling of 28,871 feet (8,800 meters).

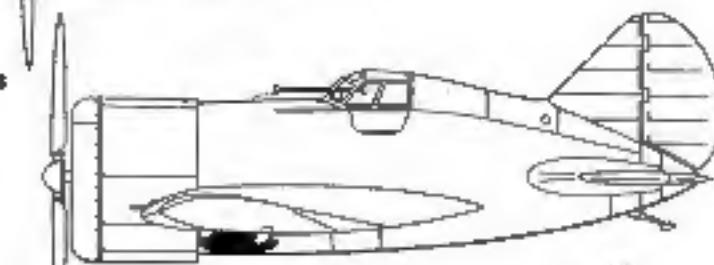
Finally the two prototypes met the stated requirements and preparations were undertaken by the Ministry for Aircraft Production to start production of the M-22 powered TsKB-12 under the designation I-16 Type 4.

## Development

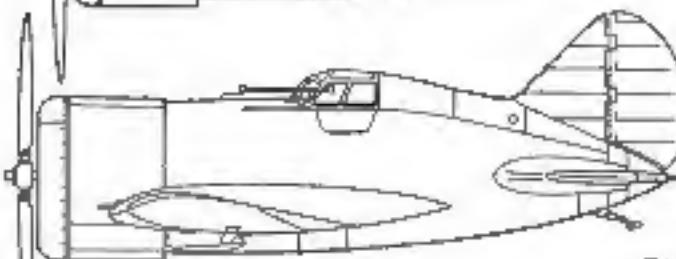
TsKB-12



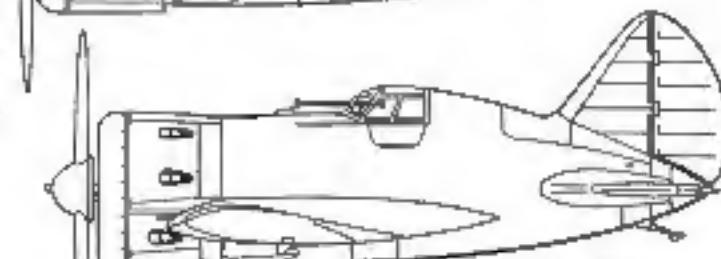
TsKB-12bis



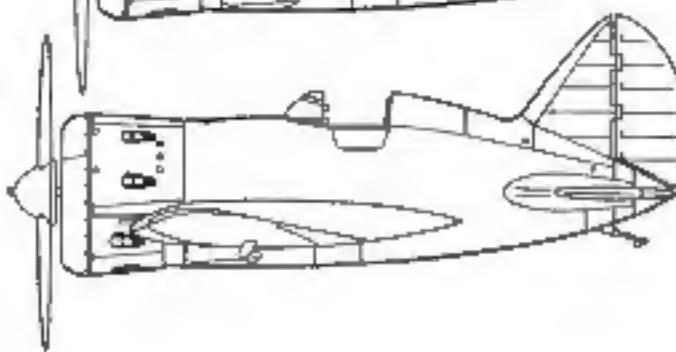
I-16 Type 4



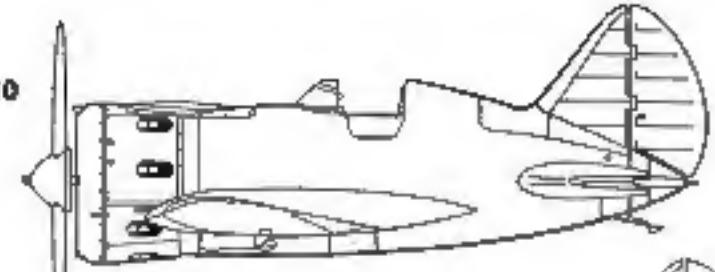
I-16 Type 5



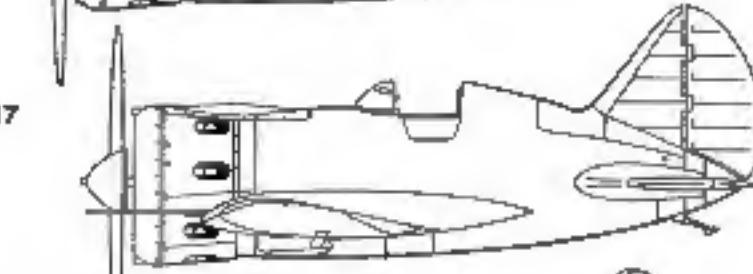
I-16 Type 6



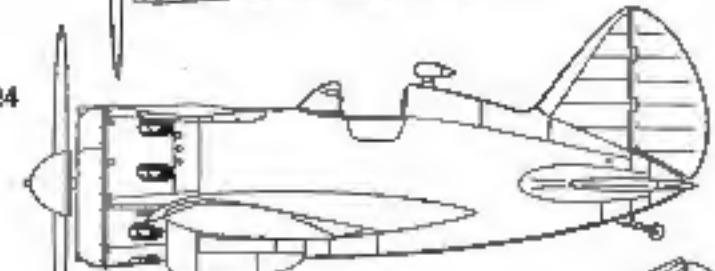
I-16 Type 10



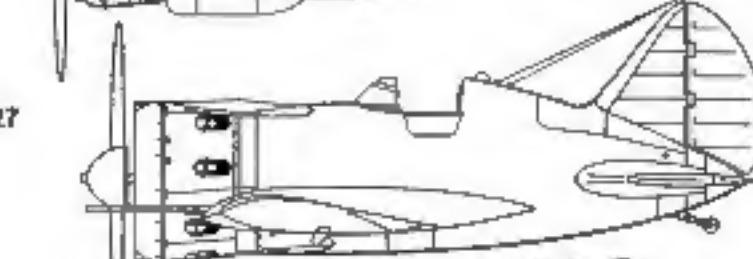
I-16 Type 17



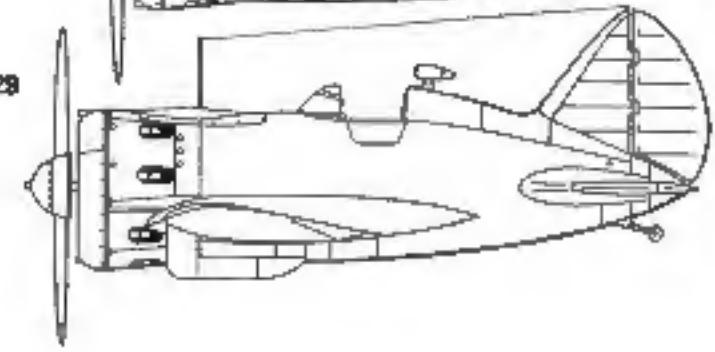
I-16 Type 24



I-16 Type 27



I-16 Type 29



# I-16 Type 4

With the I-16 Type 4 (I for *Istrebitel/Fighter*), entering production, the Soviet Air Force was about to receive its first modern, monoplane fighter and the Supreme Command wanted to take delivery of as many of these new aircraft as possible in the shortest period of time.

The first fifty-eight I-16 Type 4s were produced at GAZ-39 (GAZ/*Gosudarstvenny Aviatsionny Zavod/State Aircraft Factory*) at Khodynka during 1934. Then production was shifted to a different production site.

Even though there were still a number of problems with the I-16 that had not yet been fully resolved, preparations for production of the new fighter at GAZ-21 at Nizhny-Novgorod proceeded with top priority and some urgency. An order was issued by the Red Air Force to the Scientific Research Institute to provide technical assistance to the factory to solve the I-16's problems on a high priority basis.

Since the I-16 was the fourth aircraft type built at GAZ-21, the factory's technical documentation referred it as the I-16 Type 4, a designation which was later generally adopted by the Soviet Air Force.

Due to the fact that the Wright Cyclone SGR-1820-F-3 power plant and Hamilton-Standard propeller was not yet available in quantity and problems with the license production of the engine at Perm (under the designation M-25) had not been solved, it was decided to power the first pre-production and production I-16s with the well established M-22 engine. The 480 hp M-22 power plant, was in fact a Soviet copy of the British Bristol Jupiter VI and was built in large numbers at State Aircraft Factory 29 in Aleksandrovsk until 1936. The M-22 was normally fitted with a V-22 fixed pitch, two blade metal propeller.

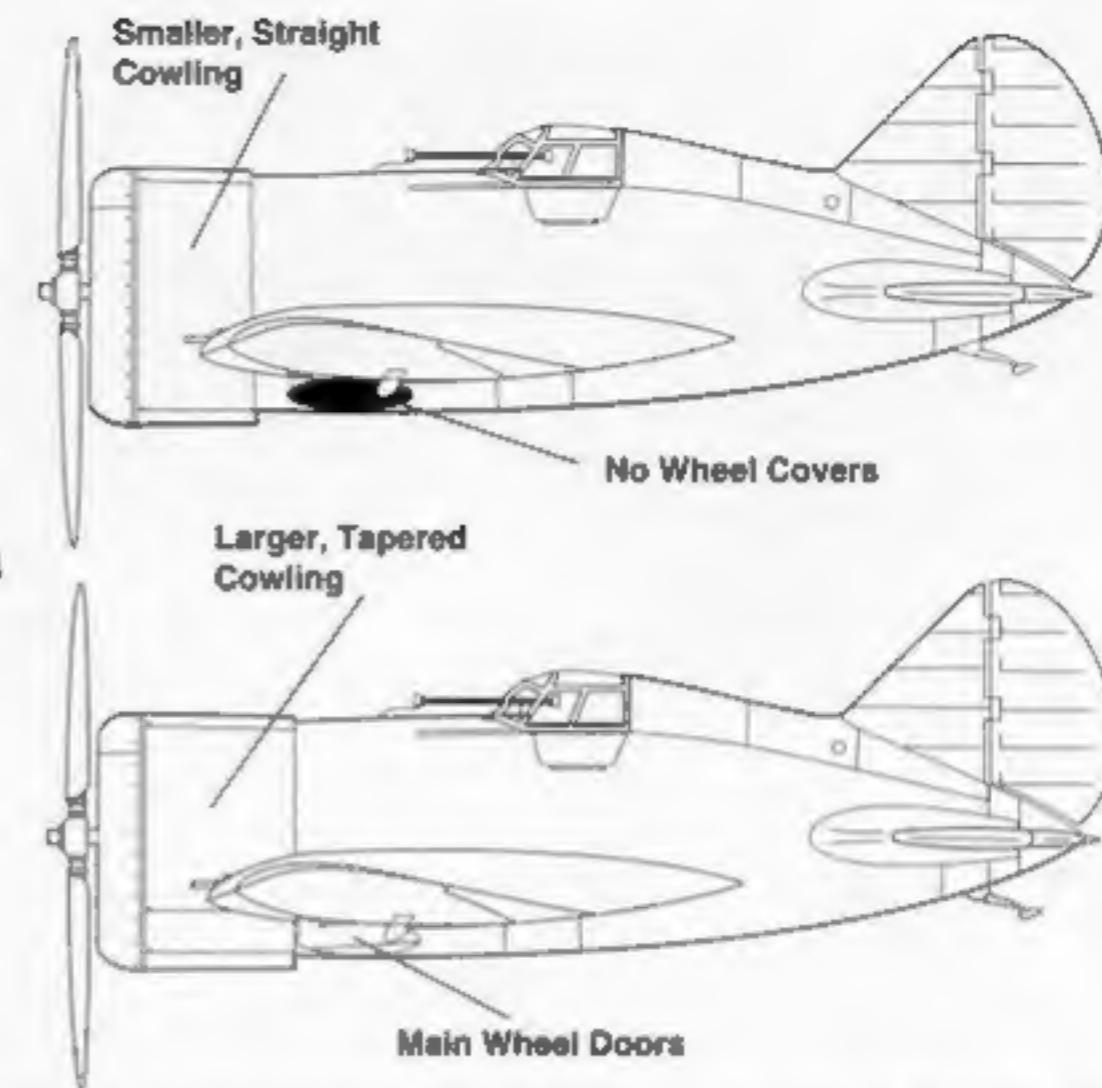
There were a number of differences between the TsKB-12 prototype and the production I-16 Type 4. The NACA engine cowling was lengthened and tapered toward the rear, a feature adopted from the TsKB-12bis prototype, although the first pre-production models of the I-16 Type 4 were delivered with the short engine cowling configuration of the TsKB-12 prototype. The dorsal spine of the I-16 Type 4 was slightly enlarged.

**An I-16 Type 4 on the ramp at GAZ-39 during 1934. The I-16 Type 4 differed from the TsKB-12 prototype in that it had an enlarged, tapered engine cowling and landing gear doors. (A. A. Zirnov)**



## Fuselage Development

### TsKB-12



### I-16 Type 4

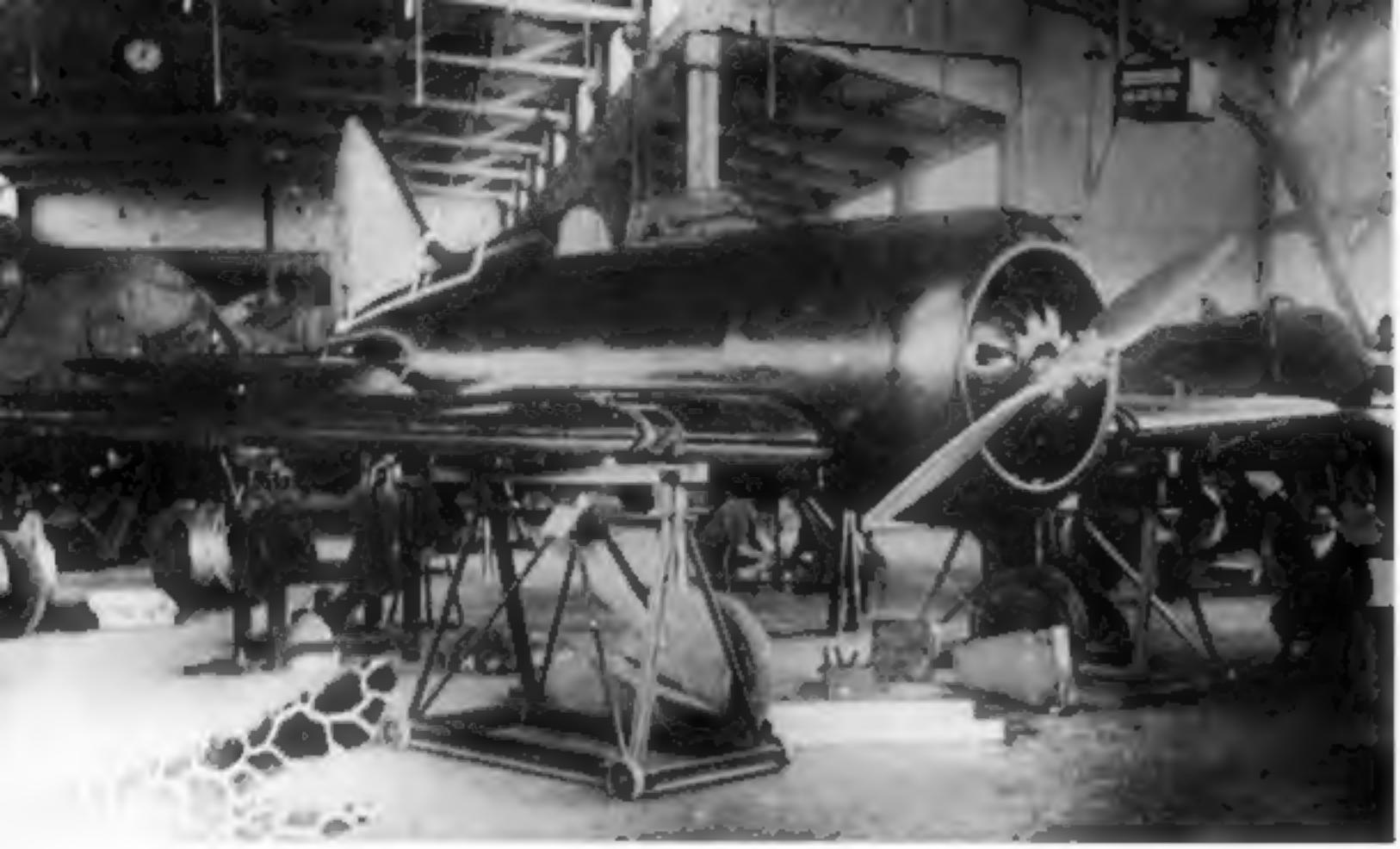
Improvements with the undercarriage also led to an enlarged main landing gear leg cover and a wheel cover was installed over the main wheel, so that both wheels and struts were completely covered in flight.

The small upper wing blister over the PV-1 7.62MM machine guns was deleted on the I-16 Type 4. Both TsKB-12 and TsKB-12bis prototypes had two small blisters on the starboard wing tip, these were deleted on the I-16 Type 4 and all subsequent production models.

The TsKB-12 prototype carried a forked pitot tube, while the I-16 Type 4 and all subsequent production models had a standard unforked pitot tube. The I-16 Type 4 was the first Soviet fighter to feature armor protection for the pilot, with an 8MM section of armor plate installed behind the pilot's seat.

The I-16 Type 4 was of mixed construction, the fuselage being made of wood and the wings being constructed of metal. The fuselage was built in two halves divided vertically, each half comprising four longerons and eleven pine frames. The monocoque skin was produced from layers of birch strips glued cross-grained and molded on a former. The wall thickness ranged from 4MM in the nose section to 2.5MM at the tail.

The wing spars were of KhMA chrome-molybdenum steel alloy, the center section spars being a trussed type and those of the outer set being built up from tubes. The ribs were of dural and the center section and leading edges had Type D1 aluminum alloy skinning, the remainder of the wings being fabric covered. The long-span, slot type ailerons, which also acted as landing flaps, being lowered fifteen degrees on landing, had Type D6 alloy frames



An I-16 Type 4 up on jacks during final assembly at GAZ-21 in the Autumn of 1935. This aircraft has not had its two 7.62mm machine guns mounted in the wing bays. (G. F. Petrov)

and fabric covering, as did the movable tail surfaces. Bell cranks and rigid rods were used for aileron and elevator control, cables and pulleys being employed for the rudder.

Cables were also used for the undercarriage retraction, since hydraulic retraction systems were not yet in wide spread use. The retraction process took eighteen turns of a hand-crank, which was located below the throttle and above the gun charging handles. There was no indicator to inform the pilot when the wheels were fully retracted or extended and locked.

The cockpit was enclosed by a canopy which featured an integral windscreen with an open-

An I-16 Type 4 up on wing jacks undergoing landing gear drop checks during maintenance. The two small holes in the cowling lip are cooling air intakes, not gun ports. (G. F. Petrov)



A pre-series production I-16 Type 4 being inspected by Soviet Air Force personnel. The aircraft has no propeller or national markings. (Ivan Ivanov)

ing for the OP-1 gun sight. The canopy slid forward and rearward on runners with the aid of rubber bunge cords, to overcome airflow resistance. Due to the fact that a number of Soviet pilots felt very uncomfortable with a closed cockpit, many flew with the canopy in the full forward position, which had also the advantage that a bail out would be much quicker.

Armament for the production I-16 Type 4 comprised two synchronized 7.62mm PV-1 machine guns with an ammunition supply of 900 rounds per gun. The PV-1 had a rate of fire of 780 rounds per minute and a muzzle velocity of 2,624 feet per second (800 meters per second). The PV-1 had been the standard Soviet aircraft machine gun since 1926.

An I-16 Type 4 is ready to be jacked up into place under the wing of a TB-3-4M-17F bomber, which served as the carrier aircraft for the Zveno-6 combination. (G. F. Petrov)



The first I-16 Type 4 was delivered from GAZ-21 in October of 1934. On 1 May 1935, the I-16 was presented to the public for the first time, when two flights of five I-16's flew over Red Square during the International Labor Day Celebration. In August of that same year, another formation was displayed over Tushino, on the Day of the Air Fleet. A total of 400 I-16 Type 4s were built before the more advanced I-16 Type 5, with the M-25 power plant became available and replaced it on the production lines.

The I-16 Type 4 had a take off weight of 2,985 pounds (1,354 kg) which was lighter than any Western fighter in service at the time. It had a maximum speed of 225 mph (362 km/h), a rate of climb of 2,645 feet per minute and outstanding maneuverability (it took only fourteen to fifteen seconds to make a 360 degree turn).

Due the aircraft's high wing loading, the I-16 had a landing speed of 66 mph (107 km/h) resulting in the need for longer runways than had been needed for the fighter biplanes. Since deliveries of new I-16 Type 4s to combat units could not begin before the Summer of 1935, the Soviet government made a decision to extend the length of runways on their airfields so that the I-16 could be used without problems from advanced airstrips.

The I-16 Type 4 was planned to be an interim production variant until the license built version of the Wright-Cyclone SGR-1820-F-3 became available. The I-16 Type 4, however, was suitable for developmental programs, the evolution of new operational techniques and for use in familiarizing pilots with the characteristics of the cantilever low-wing monoplane and retractable landing gear.

## TsKB-18

The TsKB-18 was an experimental development of the I-16 Type 4 with an armored cockpit and increased armament. It was the first Soviet fighter equipped armor both in front and behind the cockpit and a bucket seat. The armament was increased to four PV-1 7.62MM machine guns and provision for a 220 pound (100 kg) bomb load.

The Zveno concept consisted of a carrier aircraft, usually a TB-3-4M-17F bomber and a number of parasite fighters. The Zveno-6 combination was two I-16 Type 4 fighters, one under each wing. The first flight of a Zveno-6 took place during August of 1935. (Ivan Ivanov)



In addition to I-16 Type 4s, the TsKB-12 prototype was also used for Zveno tests. For these tests, the two wing mounted 7.62MM machine guns were deleted. The prototype was unusual in that it had different sized Red stars on the wing undersurfaces. The star under the starboard wing being larger than the star under the port wing. (Ivan Ivanov)

## Zveno I-16 Type 4

The symbolic term *Zveno* (Link) was used to identify composite aircraft component. The concept was to combine a number of aircraft, linked together in order to increase the range of the fighters used to escort heavy bomber aircraft.

The Zveno-6 consisted a TB-3-4M-17F as the carrier with two I-16 Type 4s as parasite aircraft. During the early stage of the trials, at least one TsKB-12 prototype was also involved in the test program. The TsKB-12, as well the I-16 Type 4s, were all modified with the wing machine guns being deleted. A tubular-steel frame was attached beneath each wing of the TB-3 outboard of the outer engines. These frames were used to suspend the two I-16 Type 4s. The fighters were pushed under the wing of the TB-3-4M-17F and then raised to establish contact with the release mechanism. Once secured, the landing gear was retracted. The first flight of this combination took place during August of 1935.



# TsKB-12bis Prototype (Modified)

During the State Acceptance Trials at the Scientific Test Institute of the Red Air Force (NII-VVS) the TskB L2bis prototype, powered by an American Wright-Cyclone SGR-1820-F-2 engine, was damaged in a crash landing when the landing gear collapsed.

As a result, the prototype was returned to the factory for repairs. Besides undergoing repairs, the aircraft was modified to accept the long awaited Wright Cyclone SGR-1820-F-3 engine (the Soviet Union generally referred to this engine as the RCF-3).

In November of 1933, the Soviet Union and the United States opened diplomatic relations and a short time later commercial relations between both countries started as well. For the Soviet Union this meant that it was now possible to import some of the latest American aero engines, as well other items of aviation equipment which were badly needed to achieve its goals.

The Wright-Cyclone engines were delivered directly by the Wright Aeronautical Corporation in Paterson, New Jersey to the Soviet Union. Rated at 630 HP, the Wright engine had fifty percent more power than the standard Soviet engine of the time (the 480 hp M-22 air-cooled radial). The SR-1820-F-3 was smaller in diameter than the M-22 and, although it had much better performance, it was only 158 pounds (72 kg) heavier.

Preparations for license production of the SGR-1820-F-3 got under way and the first pattern Wright engines arrived at the newly established aero engine factory, GAZ-19 at Perm. It was not until October of 1936, however, that the new engine, designated the M-25, was finally accepted and cleared for production.

The redesign of the TsKB-12bis involved the entire nose section. While the TsKB 12, the original TsKB-12bis and the production I-16 Type 4 all had a constant chord NACA cowling, the modified TsKB-12bis had a new, so called Waller-cowling, which was marginally smaller in diameter, tapered toward the rear and equipped with nine forward facing shutters to control the cooling air flow. The internal exhaust collector ring was replaced with eight individual exhaust stacks with scalloped exhaust ports in the cowling. The two small air intakes on the upper cowling lip were deleted.

During the modification program, a number of other improvements were also incorporated. The modified TaKB-12bis prototype differed from the I-15 Type 5 in having more oval exhaust ports and two small blisters on the starboard wing tip. This prototype carried no national markings. The aircraft served as the pattern for the production I-16 Type 5. (Ivan Ivanov)



A pre-production I-16 Type 5 during service evaluations. The engine exhaust ports are teardrop shaped and the aircraft is fitted with a tailwheel. Production standard I-16 Type 5s would be equipped with a tailskid instead of a tailwheel. (Ivan Ivanov) based on previous flight tests. The fabric covering of the center wing section and the wing tips was replaced with metal. The improved rigidity of the wing resulted in a considerable strengthening of the wing during high speed flights and high G maneuvers.

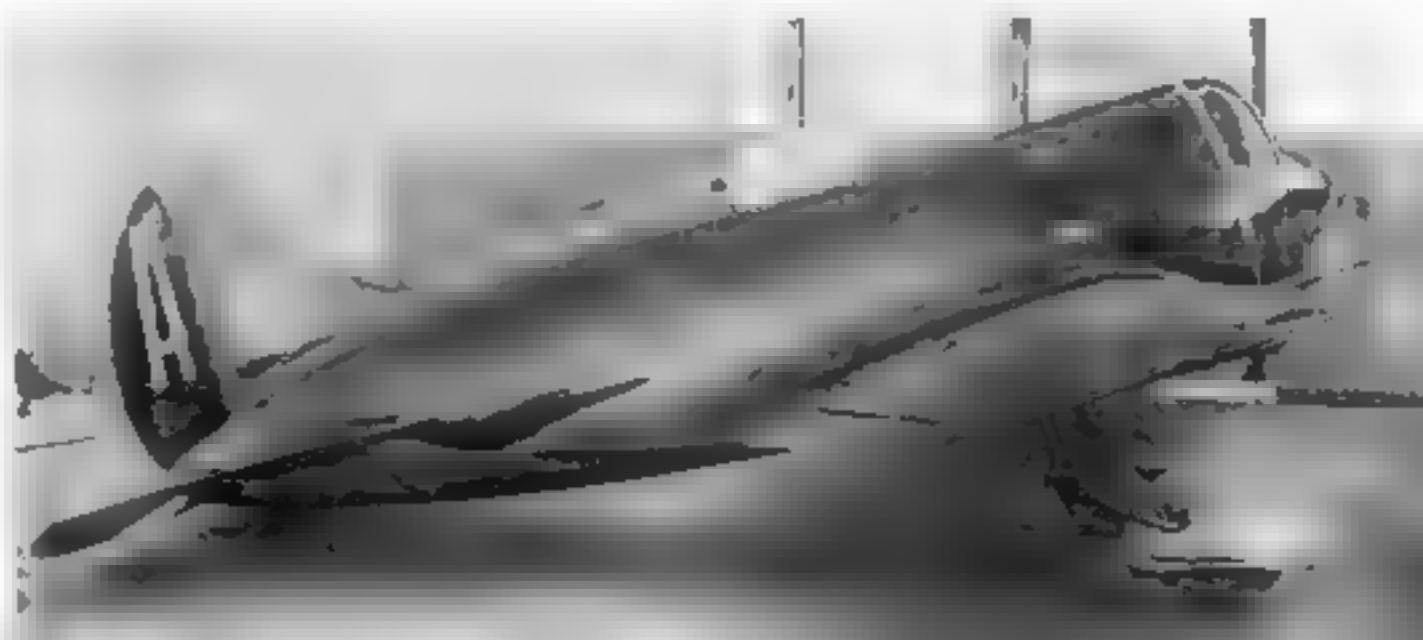
The modified TsKB-12bis prototype was equipped with an American two blade Hamilton Standard propeller, which replaced the three blade propeller used on the original TsKB-12bis and had a small propeller spinner. The fuselage dorsal spine was also enlarged. Armament remained the same as the I-16 Type 4.

In September of 1934, modified aircraft was turned over for State Acceptance Trials. These test revealed some problems with the landing gear and flaps and these items were modified still further.

The flight tests, conducted between September and October 1934, soon revealed the outstanding performance of the new fighter, thanks to the increase in power offered by the American engine. The modified TsKB-12bis prototype had a top speed 272 mph (437 km/h) and a rate of climb of 2,646 feet per minute.

The High Command of the Red Air Force realized that Polikarpov had provided the country with the best performing fighter in the World. For this reason top priority was given by the People's Commissariat of the Aviation Industry and the air force to begin immediate production of the aircraft under the designation I-16 Type 5. Continued problems with engine production, however, delayed large scale production for nearly a year.

Pre-production I-16 Type 5s were powered by imported American Wright-Cyclone SGR-1820-F-3 engines. The pilot tube is longer than the one installed on the production aircraft and the wing tip position light was smaller on the production Type 5. (Ivan Ivanov)



# I-16 Type 5

## Fuselage Development

During the preparations for the license production of the RCE-3, it became clear that the new power plant could not be as easily produced as had been initially assumed. As a result, it was not until October of 1935 that the new engine designated the M-25 was finally accepted and cleared for production. As a result, the first pre-series and production I-16 Type 5s were powered by imported Wright-Cyclone SGR-1820-F-3 power plants.

Once the first M-25 power plants became available, production of a batch of M-25 powered pre-series I-16 Type 5s was undertaken at GAZ-39 in Khodinka. The M-25 was rated at 700 hp for take off and was equipped with a Stromberg NAE-7C carburetor and a Soviet copy of the "Scintilla" ignition system.

These pre-series aircraft differed from the TsKB-12bis prototype in having the exhaust port slightly modified. Instead of a rounded rear port, the port was given a teardrop shape. In addition, the small propeller spinner used on the TsKB-12bis was replaced by a larger spinner on all production I-16 Type 5s.

While the TsKB-12bis prototype lacked landing gear strut covers and had no main wheel cover, the I-16 Type 5 adopted the same landing gear covers that had been introduced on the production I-16 Type 4. In addition, the tailskid of the TsKB-12bis was replaced by a tail wheel on some pre-production I-16 Type 5s.

A number of pre-series aircraft were test flown by the NII VVS. On the pre-series aircraft take off weight had risen from 3,152 pounds (1,430 kg) to 3,384 pounds (1,535 kg), but due to other improvements, the aircraft turned in a top speed of 283 mph (457 km/h) without losing any of its maneuverability. This speed was some fifty mph faster than the latest contemporary American fighter in service, the Boeing P-26A.

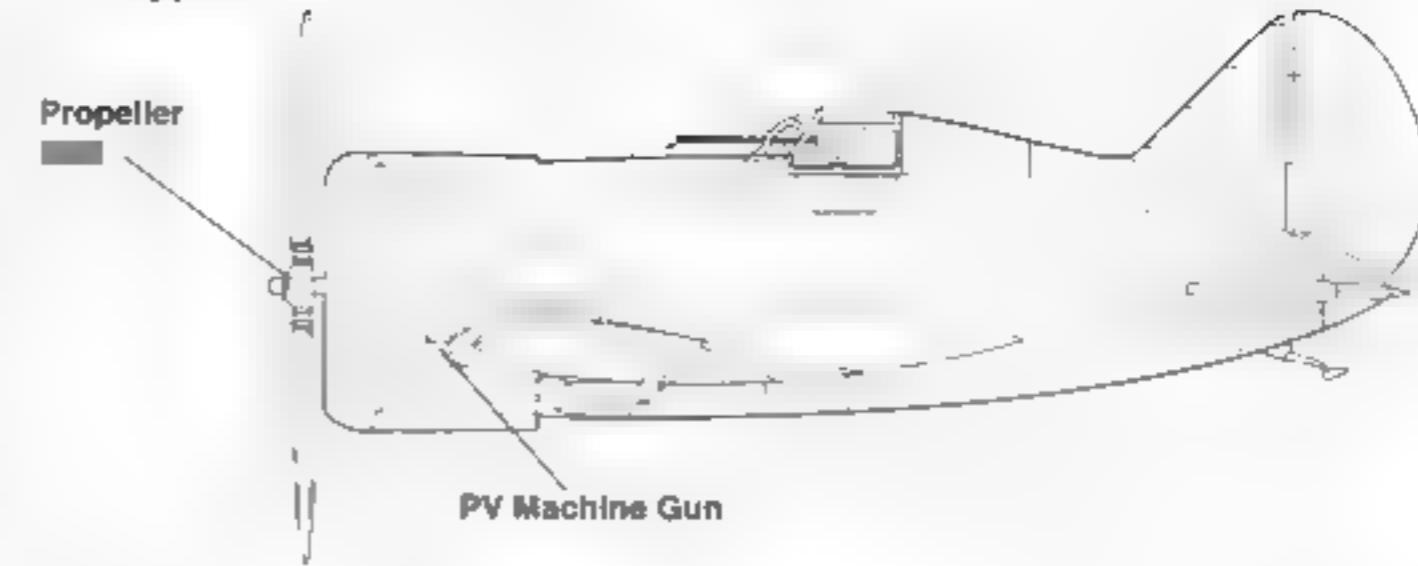
The Soviet government had made no effort to conceal the development of the I-16 and had, in fact, exhibited a pre-production example of the I-16 Type 5 at the International Aeronautical Salon at Milan, Italy, held between 12 and 28 October 1935. At the Milan Fair the I-16 drew considerable attention due to its retractable landing gear and glazed canopy.

Production of the new type started in early 1936 at both GAZ-21 and GAZ-153. By the

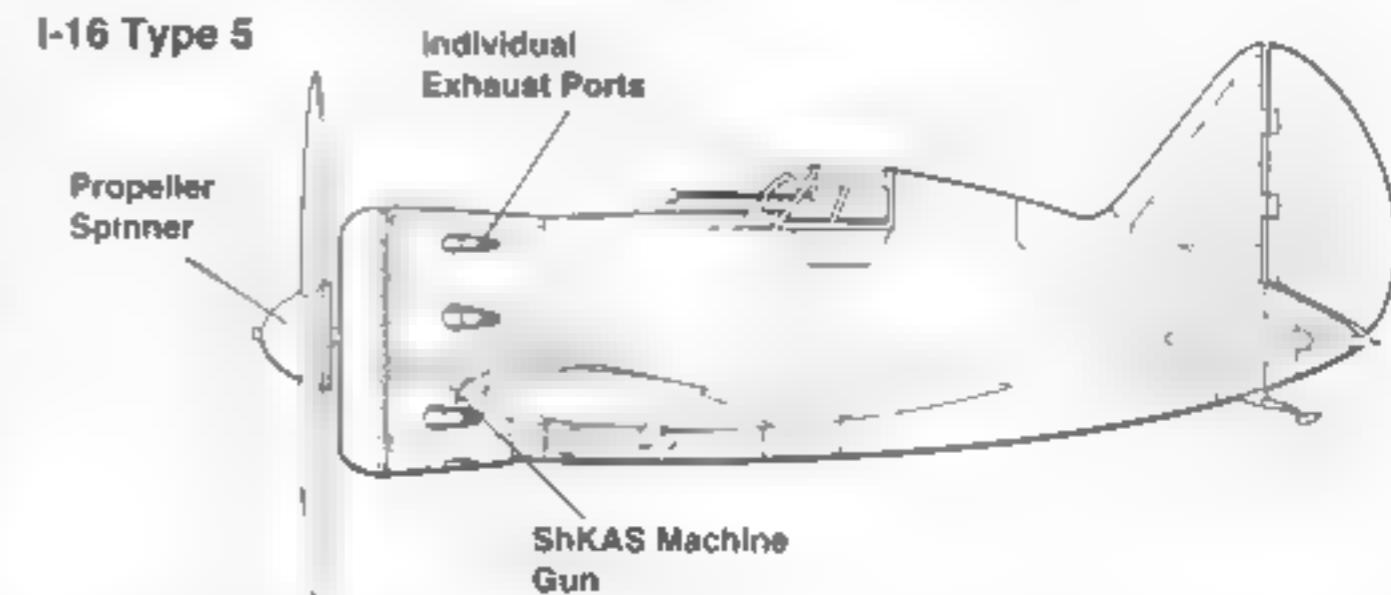
**I-16 Type 5s of the 8th Fighter Aviation Regiment, Black Sea Fleet warm up their engines before starting a mission from their home base at Kacha airfield during 1941. The aircraft in the foreground has had the main landing gear wheel doors removed. (Andrew Zinchenko)**



### I-16 Type 4



### I-16 Type 5

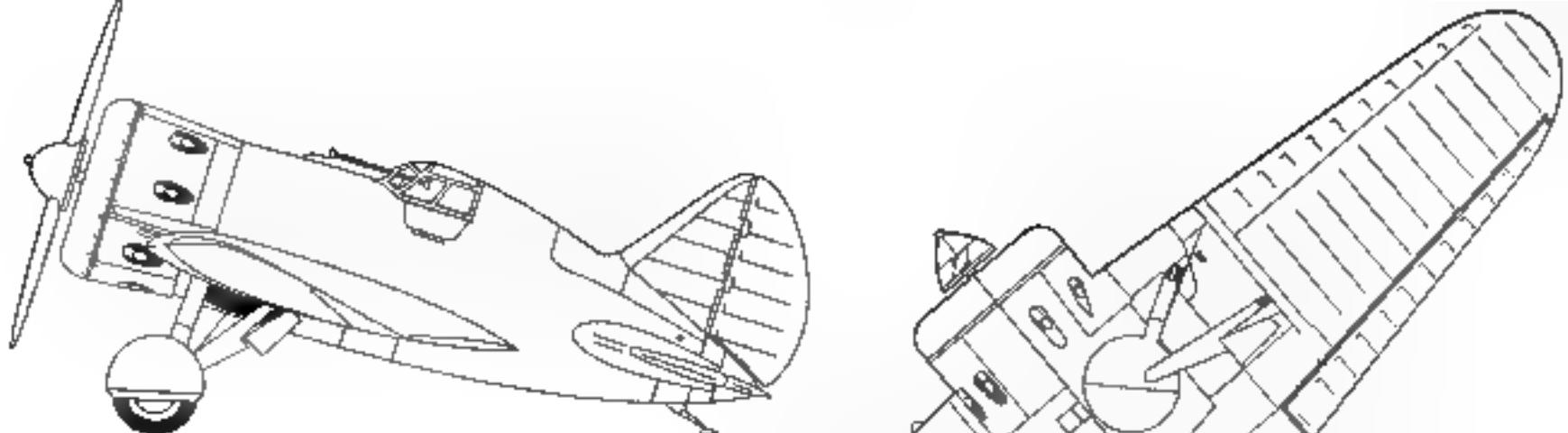


time production of the I-16 Type 5 and Type 6 was phased out in late 1937, some 2,200 aircraft had rolled off the production line.

The standard production I-16 Type 5 differed from the pre-series aircraft in having the tail-wheel replaced by a tailskid. The firepower was augmented by replacing the two standard PV-1 machine guns with the new ShKAS-62mm weapon. The two ShKAS were placed in the wings, outside of the propeller arc and had a rate of fire of 1,800 round per minute with a ammunition supply of 900 rounds per gun. There was also a provision for carrying a 440 pound (200 kg) bomb load. All I-16 Type 5s were equipped with the OP-1 telescopic gun-sight, which was also used on the earlier I-15 and I-152 biplane fighters.

The cockpit itself was decidedly snug for a but the simplest of pilots. The seat could only be adjusted vertically and equipment was spartan. The rudimentary instrumentation included altimeter, rate of climb, turn-and-bank and oil temperature indicators. These instruments were, for the most part, license-manufactured American Pioneer-Bendix gauges. The cockpit, as well as the pilot's seat, was painted at the factory a Greenish Gray while the instrument panel was Dark Green. The back and headrest were generally upholstered in Black leather.

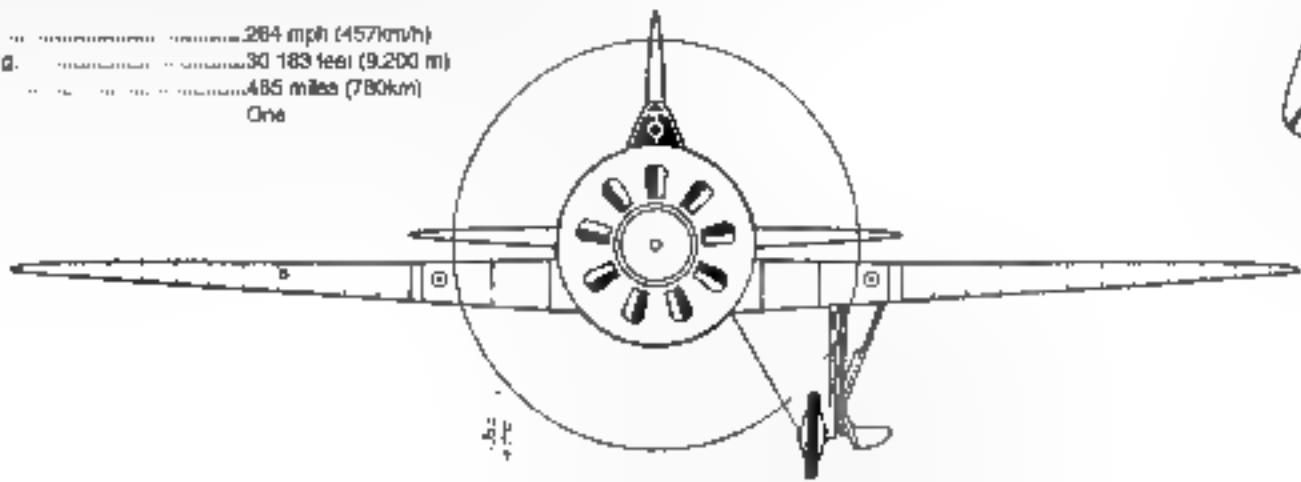
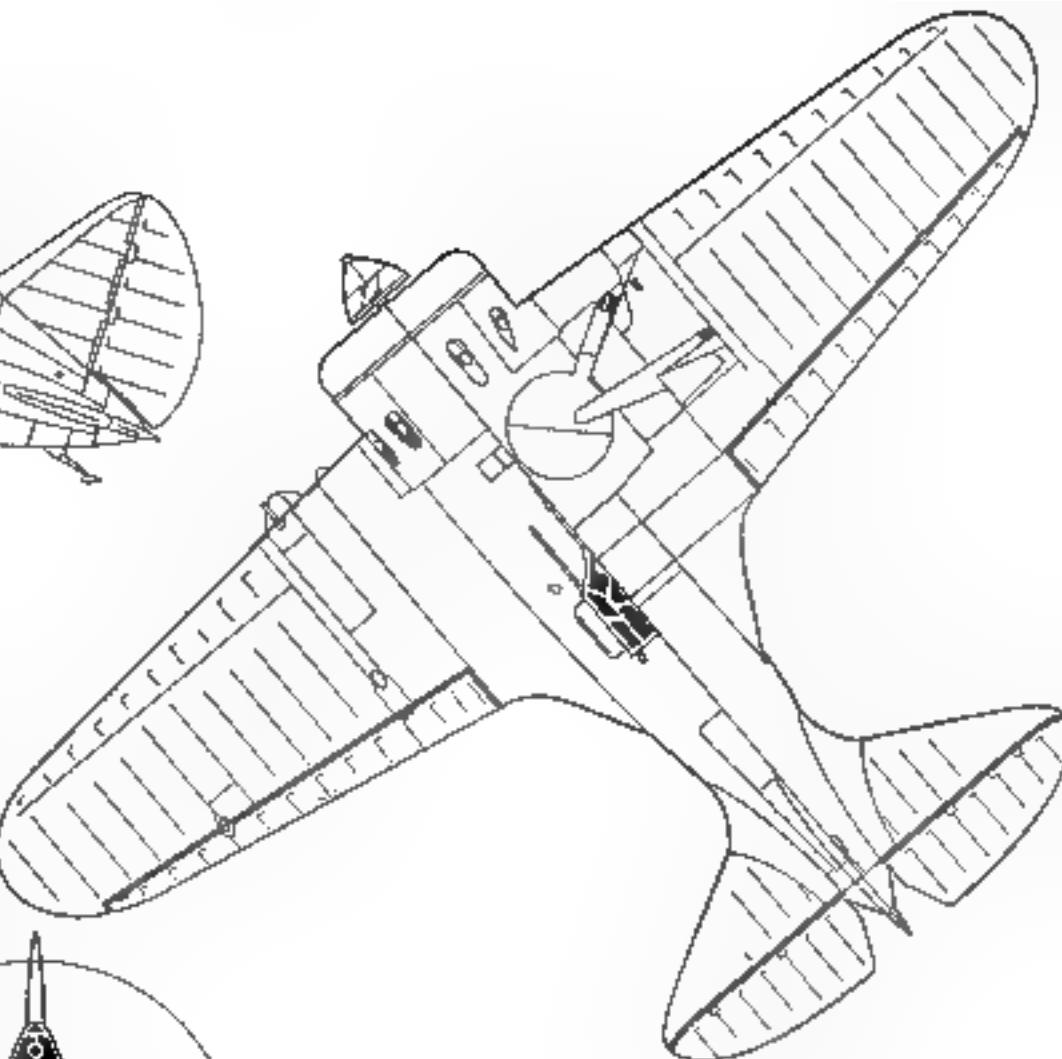
The I-16 Type 5 was less suited to close-in high G maneuvering combat than its biplane contemporaries, although it possessed the advantages of superior speed and climb. Its ailerons



## Specification

### Polikarpov I-16 Type 5

Wingspan	29 feet 1 3/4 inches [8.84 m]
Length	19 feet 8 1/8 inches [6.02 m]
Height	7 feet 8 3/4 inches [2.36 m]
Empty Weight	2,484 pounds [1,120 kg]
Maximum Weight	3,264 pounds [1,480 kg]
Powerplant	One 7.0 hp Shvetsov M-25 air-cooled engine
Armament	Two T.52mm ShKAS machine guns
Speed	264 mph (457 km/h)
Service Ceiling	30,183 feet (9,200 m)
Range	485 miles (780 km)
Crew	One



were feather-light and it had an exceptional rate of roll. It also had an outstanding zoom climb capability.

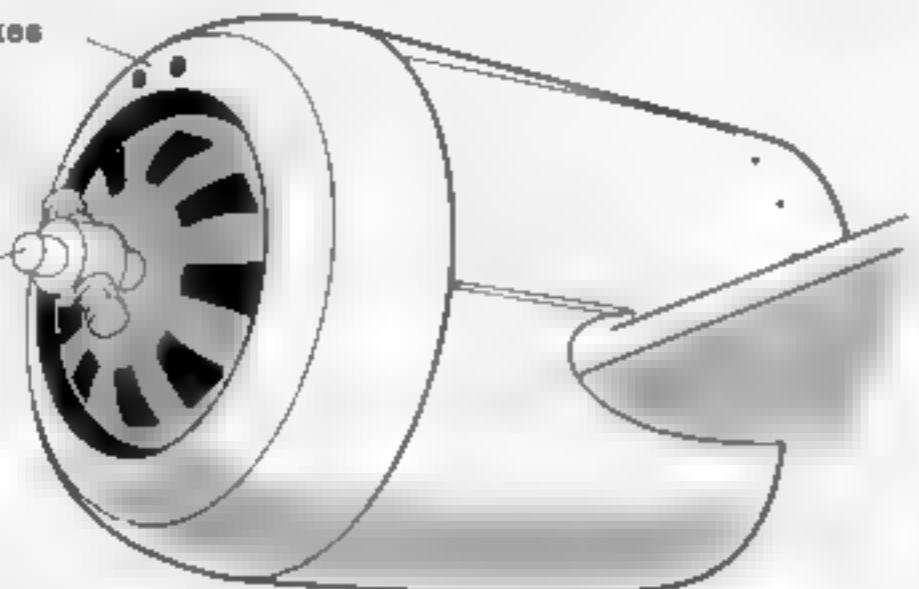
The I-16 Type 5, however, was no aircraft for a novice. It was overly sensitive to control movements and longitudinal stability was marginal. The fighter also tended to stall out in a glide. Instability in a climb and in turns demanded the highest concentration on the part of the pilot and the rigidly-mounted engine produced an annoyingly high vibration level.

Unless extreme care was exercised, use of the split ailerons as flaps on landing approach could result in the nose of the fighter pitching up and the aircraft entering a stall. When the undercarriage was lowered, the aircraft immediately became sluggish, buffeting was severe and power had to be kept up, since there was a marked tendency to drop a wing. The I-16 had to be literally flown onto the ground, stalling at anything up to 93 mph (150 km/h), and as only one of the three legs of each main landing gear member incorporated an oleo shock absorber, the damping of the landing impact was inadequate and the aircraft tended to bounce often resulting in a dangerous nose-up attitude.

Because of these handling problems, the service introduction of the I-16 Type 5 was to prove difficult and the high accident rate it experienced during its initial stages brought near rebellion in the ranks of the Red Air Force fighter pilots.

## Engine Cowlings

I-16 Type 4 Air Intakes

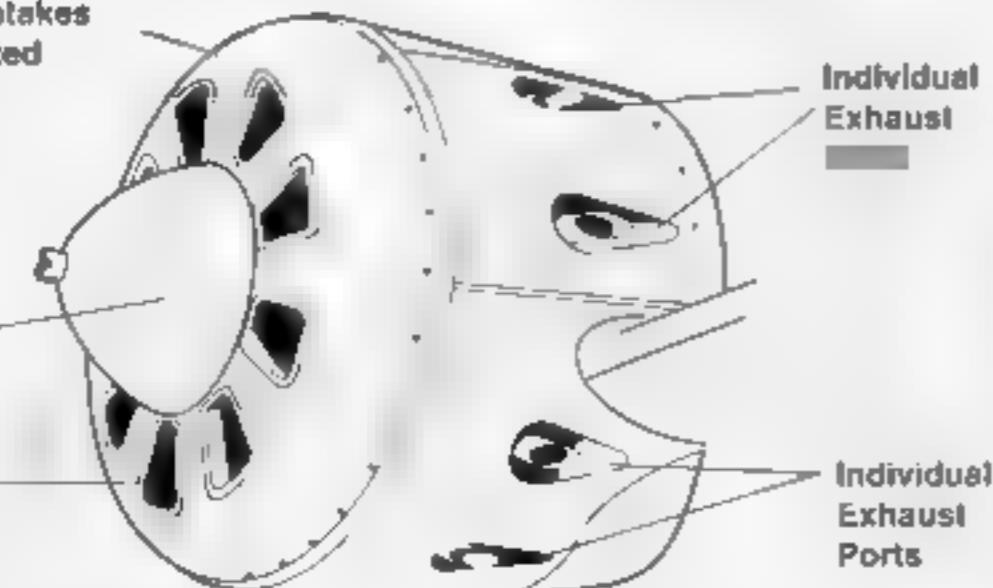


I-16 Type 5

Air Intakes Deleted

Propeller Spinner

Movable Cooling Shutters



Armorers reload the wing guns of an I-16 Type 5. The two wing guns were fed from ammunition boxes in the forward fuselage. (Ivan Ivanov)

Another shortcoming, in the opinion of many average pilots, was the enclosed cockpit. Before the introduction of the I-16, all Soviet fighters had open cockpits. Pilots believed that the sliding canopy would restrict movement and they would be unable to move their heads from side to side to check the rear. Most pilots did not believe that the wind shield always worked efficiently, especially if they had to bail out.

To convince average service pilots, test pilots P. Sistanovskij, S. Suprun, V. Yevseyev, Y. Preman and V. Rakhov began touring the Red Air Force fighter units to demonstrate the

Red 4, an I-16 Type 5 was captured by the Germans at Riga Airfield in Latvia. The aircraft in the background include several British-built Gloster Gladiator biplane fighters of the former Latvian Air Force, which had been captured by the Russians when they invaded Latvia. (Gunter Wiesinger)





This I-16 Type 5 was captured at Siauliai in Lithuania. The tip of the fin was in Red with a thin White stripe. The rear landing gear strut doors have been removed from this fighter (Wolfgang Tamme)

advantages of the I-16 in November of 1937. Soon the doubts and fears of I-16 Type 5 pilots were dissolved. During their tour through various Fighter Aviation Regiments, the test pilots

A German soldier inspects an I-16 Type 5 which has a gun camera mount behind the cockpit. The gunsight has been removed by the Luftwaffe, a common measure meant to render the aircraft ineffective. This aircraft carries no tactical number (Heinz Birkholz)



This I-16 Type 5, Yellow 9, had been equipped with a RSI-3 radio, as the short antenna mast on the fin indicates. The slightly damaged propeller indicates that the aircraft had shut down its engine prior to landing. (Dr. Volker Koenig)

performed not less than 3,318 aerobatic demonstration flights with their I-16 Type 5s

Most of the I-16 were delivered from the factory with Olive Green uppersurfaces and Light Blue undersurfaces. The V-25 propeller was painted in Aluminum, while the spinner was Olive Green. Some I-16 Type 5s were delivered with a Black or Light Blue spinner. A number of early I-16 Type 5s were painted with Black engine cowlings. At this time, a considerable amount of Soviet paint was imported from Nazi-Germany, as a result, the colors applied on Soviet pre-war fighters was very similar to German aircraft colors. Until the Summer of 1941, the national markings were applied on top of the upper wing and on bottom of the lower wing as well as on the fuselage. The Red star as a national marking always had a thin Black outline. The tactical number was usually applied on the rudder and had a thin White outline.

During operational service, the main wheel cover was sometimes removed as a field modification, since the covers were quite often damaged during operations from unprepared fields. When the gun camera pod became available, the I-16 Type 5 was retrofitted with the gun camera on the dorsal spine behind the pilot's seat.

Only a few I-16 Type 5s were retrofitted with a short wave RSI-3 (RSI = *Radiostanicya dla Istrebitelей*/Radio for fighter), identifiable by the installation of a small mast on top of the vertical fin. The RSI-3 consisted a receiver and a transmitter. Usually, only the lead plane in a formation was equipped with both, sender and receiver equipment, while the remaining planes had either only a receiver or no radio at all. Both the RSI-3 receiver and transmitter were powered by the RUN-30 accumulator. Sender and transmitter had five fixed frequencies which had to be selected on the ground before a mission.

Some I-16 Type 5s were fitted with a small trim tab on the flap as a field modification. This trim tab in the inboard flap became standard on late production I-16s.

The I-16 Type 5 was still in active front-line service when the Germans invaded Russia on 22 June 1941. A number of I-16 Type 5s fell into enemy hands during the early stage of the war, when the Germans occupied airfields in Belorussia, the Ukraine, Lithuania and Latvia. At Riga, the Latvian capital, a large number of I-16 Type 5s shared the airfield with British built Gloster Gladiators, which had been seized by the Red Army during its invasion of the Baltic countries.



This I-16 Type 5 was fitted with a non-retracting ski landing gear and served as the test bed for the M-25V power plant. White 6 carried a larger propeller spinner, which would become standard on later variants of the I-16 (Type 18 onward). (Ivan Ivanov)

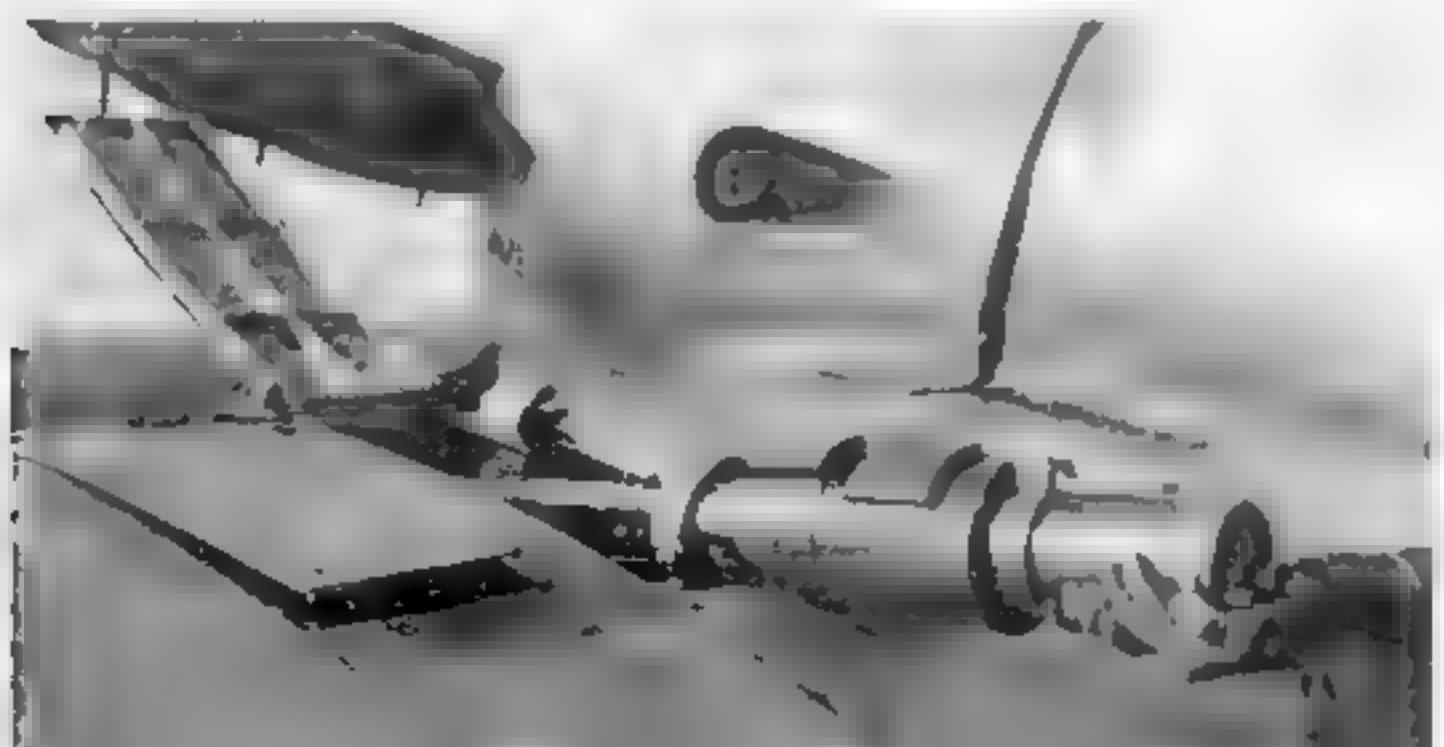
## Ski-Landing Gear

There were a number of tests conducted with I-16 Type 5s fitted with a ski landing gear. Instead of wheels, two skis were fitted on the main landing gear struts. The skis were fixed during flight with two spring equipped bands, so that they would not flutter during flight. An additional ski was fitted on the tailskid. When fitted with skis, the landing gear could not be retracted. During the evaluation of the M-25V power plant on the I-16 Type 5, the testbed I-16, White 6, was modified with a larger propeller spinner which later became standard on the I-16 Type 18 onwards. During the winter, a substantial number of I-16s were equipped with skis.

## Ground-Attack I-16 Type 5

Two I-16 Type 5s were experimentally equipped with six ShKAS 7.62MM machine guns mounted in the wing center section and outer wing panels. These guns were able to be elevated up to 20 degrees. This variant, which was produced in late 1936 as a ground-attack aircraft, was not built in quantity.

A ground crewman installs the port ShVAK 20MM cannon in the wing bay of the I-16P prototype. The I-16P was the first Soviet fighter aircraft to carry a 20MM cannon. (Ivan Ivanov)



The I-16P was powered by an imported Wright-Cyclone engine and was armed with two 7.62MM machine guns and two 20MM cannon. (Ivan Ivanov)

## TsKB-29

The TsKB-29 was developed as a high speed dive bomber and was powered by an imported Wright-Cyclone SGR-1820-F-3 engine. This version of the I-16 Type 5 was manufactured and test flown during 1936 and differed in having pneumatic landing gear and flap retraction, with the flaps being separated from the ailerons. It was armed with two ShKAS 7.62MM machine guns and a 440 pound (200 kg) bomb load could be carried on hardpoints under the wings.

## I-16P (Cannon)

The I-16P was based on the I-16 Type 5 airframe powered by an imported Wright-Cyclone SGR-1820 F-3. The I-16P differed from the standard production I-16 Type 5 in having an armament of two wing mounted ShKAS 7.62MM guns and two synchronized 20MM ShVAK cannons with 150 rounds per gun. The cannons were mounted in the wing, close to the fuselage and fired through the propeller arc. The aircraft could also carry six Type Der-31 bomb containers under the wings.

There were two I-16Ps built, both with the same armament installation. One I-16P had retractable landing gear while on the other I-16P prototype had a fixed landing gear with the main wheel covers deleted and the gear wells in the fuselage fairings.

This was the first 20MM cannon installation in a Soviet fighter. Tests revealed that the flying characteristics were about the same as the standard production I-16 Type 5. The first tests were carried out successfully, but the recoil operated cannon was not mounted in a production aircraft (I-16 Type 17) for another two years.

## Zveno I-16 Type 5

I-16 Type 5s were also used for Zveno parasitic fighters with the carrier aircraft normally Tupolev's large TB-1 and TB-3 bombers. The fighters were attached under the wings of the carrier aircraft, and released by the pilot. They were secured on three points, the rear one was unlocked first, followed by the two front ones.

Technically take offs and landings of the carrier with its load of fighters never caused any major problems. There were, however, incidents when wheels or propellers caused minor



The *Zveno-6 SPB* consisted of a TB-3-4AM-34RN bomber with two I-16 Type 5s suspended under the wings. The I-16s were armed with a pair of FAB-250 HE bombs. The first flight of this combination took place during July of 1937 from Zhukovsky airfield. (Ivan Ivanov)

damage to the corrugated skin of the carrier when the fighter was released or hooked back on. The most difficult part of the mission was when the fighters rejoined the carrier.

The *Zveno-6* used a Tupolev TB-3-4M-17F as the carrier aircraft plus two early production I-16 Type 5s. The I-16 Type 5s were suspended under the wings of the Tupolev bomber.

The *Zveno-7* was a single TB-3-4AM-34RN with three I-16 Type 5s, which were all hooked on and released during the flight. This combination, however, was discontinued.

The *Zveno-Ariamarka* (Link-Mother) was a Tupolev TB-3-4M-17F carrier with two I-16s fitted under the inner wings and two I-5s on top of the wing outer panels. When the aircraft took off for its maiden flight on 20 November 1935, a further I-Z fighter was hooked on during the flight and later, together with the remaining four fighters, released.

There was a *Zveno* variant developed to attack small targets, using two I-16s as dive bombers. The TB-3 would carry the two fighters near the target where the I-16s, armed with bombs, should be released and attack the targets in a sharp dive. After accomplishing their mission, the I-16s would return to the nearest friendly base. The *Zveno-6 SPB* (*Sostavnyy Prikryvayushchiy Bombardirovshchik*/Composite Dive Bomber) included a TB-3-4AM-34RN plus two I-16 Type 5s armed with two FAB-250 HE bombs. These I-16 Type 5s had their wing guns deleted during the trials and the first flight took place during July of 1937. The total take off weight of the *Zveno-6 SPB* exceeded twenty-two tons, and the composite reached a speed of 166.5 mph (268 km/h). During the trials, it was reported that some ninety percent of the bombs dropped fell within the target area, an outline of a destroyer sized ship painted on the ground.

The *Zveno-6 SPB* was introduced during the Air Parade over Tushino on occasion of the Day of Aviation on 18 August 1940. During the demonstration a mock attack was flown by other Soviet fighters against the TB-3-4AM-34RN. At that moment, the two I-16 Type 5s were released and engaged the "enemy".

There were two I-16 Type 5s converted to allow them to hook on during flight to the fuse pickup point on a TB-3 in a similar procedure to that used with the I-Z fighter on the *Zveno-Ariamarka* project. For these trials, an I-16 Type 5 was modified with a hook-boom device in front of the canopy, which was strengthened by two additional struts leading to each side of the canopy frame. The wing guns were deleted on this particular testbed. The second version was equipped with a strengthened boom with two struts mounted between the two main attachment struts.

Gradually it was learned that the upper variants, with the fighters mounted on top of the carrier's wing, caused more problems due effort required to mount the fighters on top of the TB-3 wing. The 'lower' variant, with two I-16 Type 5s suspended under the wing, was consid-

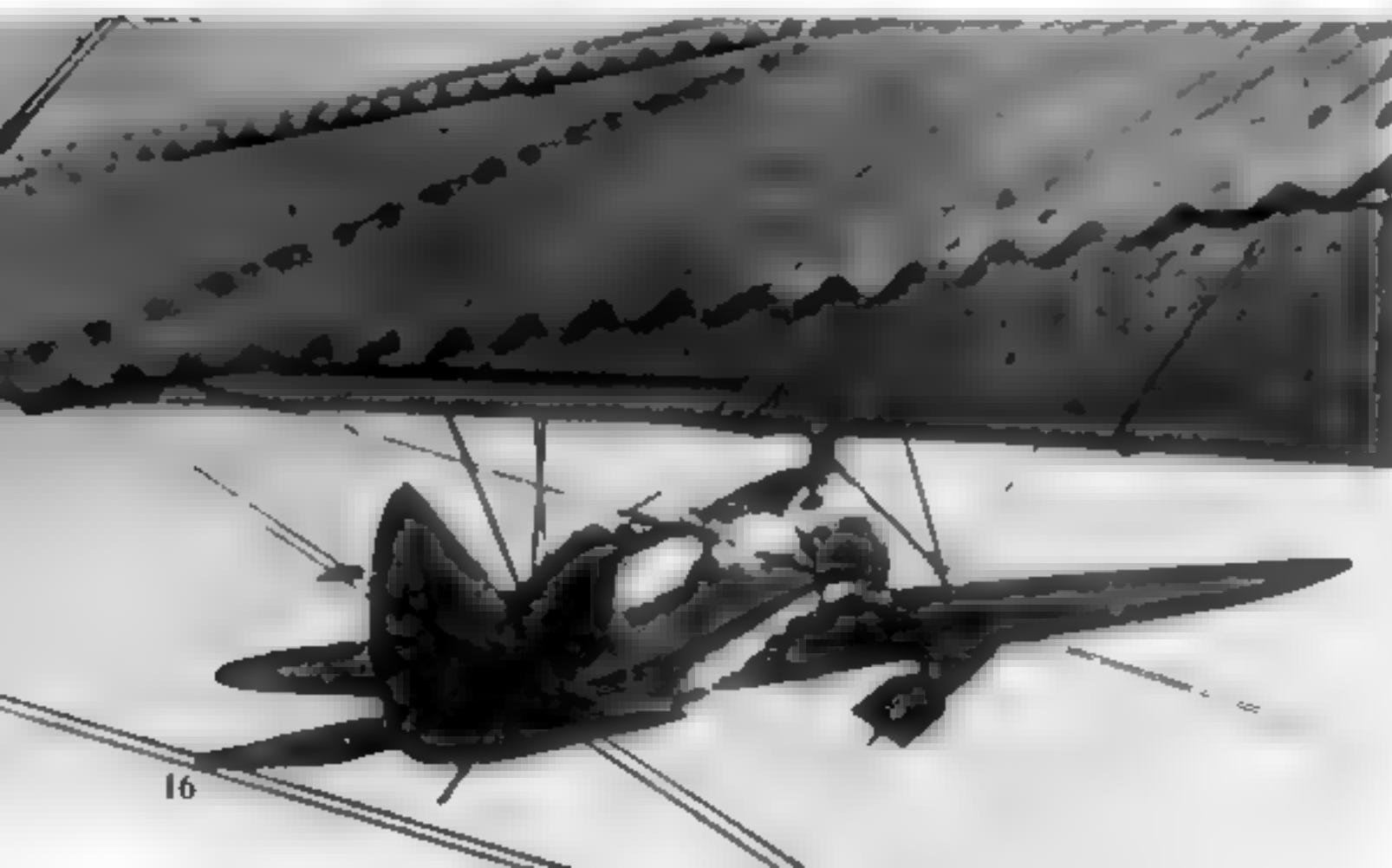


While the earlier version of the nose lock on device lacked the rear support struts, all later versions included these struts for added strength. In the event, the fuselage hook on method for the I-16 was abandoned, relying on only the underwing method. (Ivan Ivanov)

erably easier to handle. The *Zveno-6 SPB* was introduced during the Air Parade over Tushino on occasion of the Day of Aviation on 18 August 1940. During the demonstration a mock attack was flown by other Soviet fighters against the TB-3-4AM-34RN. At that moment, the two I-16 Type 5s were released and engaged the "enemy".

There were two I-16 Type 5s converted to allow them to hook on during flight to the fuse pickup point on a TB-3 in a similar procedure to that used with the I-Z fighter on the *Zveno-Ariamarka* project. For these trials, an I-16 Type 5 was modified with a hook-boom device in front of the canopy, which was strengthened by two additional struts leading to each side of the canopy frame. The wing guns were deleted on this particular testbed. The second version was equipped with a strengthened boom with two struts mounted between the two main attachment struts.

Gradually it was learned that the upper variants, with the fighters mounted on top of the carrier's wing, caused more problems due effort required to mount the fighters on top of the TB-3 wing. The 'lower' variant, with two I-16 Type 5s suspended under the wing, was consid-





This I-16 Type 5 has been hoisted into place on the underwing support struts of the TB-3-4M-17F bomber and its landing gear is just clear of the ground. (A.A. Zimov)

ected the best solution, and this variant passed State Acceptance Trials on 25 May 1938

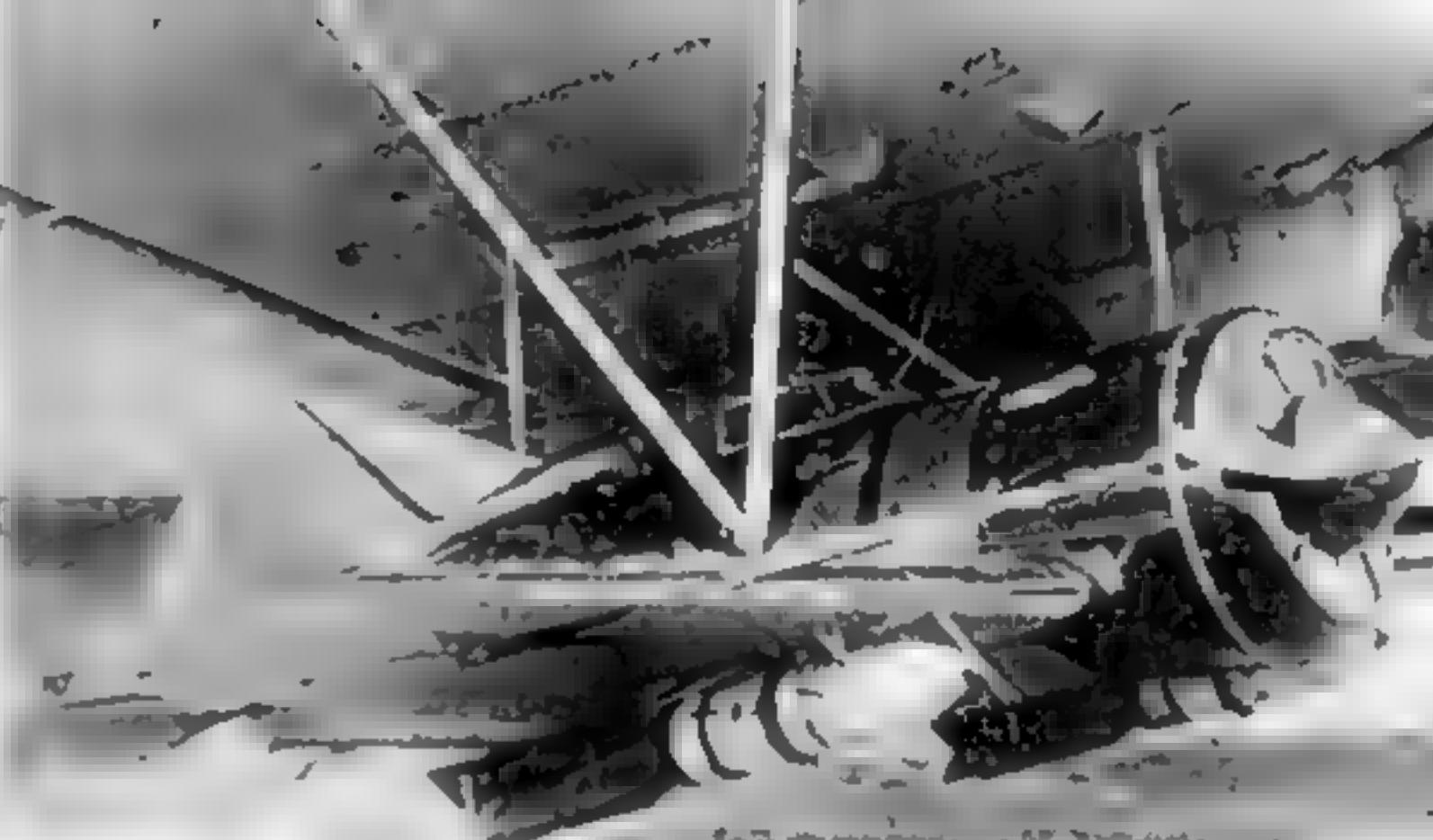
The *Zveno-6 SPB* saw also combat during the Great Patriotic War with the *Aviatsiya Voyenno-Morskogo Flota* (Soviet Naval Aviation). In July of 1941, Vladimir Sergeyevich Vakhmistrov arrived at Evpatoria, Crimea to supervise the training of the six *Zveno-6 SPB* crews. The TB-3-4AM-34RNs were furnished by the 63rd Bomber Aviation Division commanded by Lieutenant Colonel N.S. Pavlov, a veteran from the Spanish Civil War, while the I-16s came from the 2nd Squadron of the 32nd Fighter Aviation Regiment, which was part of the 62nd Fighter Aviation Division. The 2nd Squadron was under the command of Captain Arseny V. Shubikov and the *Zveno* combination was nicknamed by the Black Sea Fleet pilots as *Podveski Shubikova* (Shubikov's Pods). It was planned to use the composite aircraft to attack highly defended targets in Romania.

Since it was discovered that the range of the I-16 would be insufficient for the trip from the target back to the base at Evpatoria, engineer Pavel Telepnev designed and built 95 Liter drop tanks which were fitted under the fuselage of the I-16 to increase the endurance by about thirty-five minutes.

The first *Zveno-6 SPB* mission was flown on 1 August 1941, against the harbor of Constanta. The two TB-3-4AM-34RN were flown by Serafim Gavrilov and Nikolai Ognyev while the four I-16 were piloted by Captain A.V. Shubikov, 1st Lieutenant B.I. Filimonov, Lieutenant B.M. Litvinchuk and Lieutenant A. Samarev. About twenty five miles (40 km) from the target, the two I-16s were released over the Black Sea at an altitude of 4,000 meters. The fighters dropped their bombs over the harbor, damaging the DUROSTOR and sinking the tug AMARILIS. During an attack on the rail marshaling yard, six rail cars were damaged, three workers were killed and four others injured. While enroute back to base, the two I-16s were attacked by Messerschmitt Bf 109s, but there was no loss recorded on either side.

A second mission was flown a day later when three *Zveno-6 SPB* were scheduled to attack ships in the harbor of Constanta. Before the I-16s could be released, the formation was spotted by a Messerschmitt Bf 109. During the dive bombing attack against the ships, the I-16s encountered heavy anti-aircraft fire and, shortly after releasing their bombs, they were engaged by Messerschmitt Bf 109s. From the six I-16 dispatched in the mission, four landed safely back at Odessa, while the remaining two were reported as missing in action.

The third mission, on 3 August, was directed against the oil refinery and oil storage depots at Constanta. Enroute to the target, two MBR-2 flying boats escorted the two TB-3-4AM-34RNs. At an altitude of 13,123 feet (4,000 meters), the four I-16 were released some nine miles (15 km) from the target. During the attack, bombs were observed to hit the harbor of



Once the I-16 was securely in place under the wing, the landing gear was retracted. The wing guns of this I-16 have been removed for the service trials of the *Zveno-6*. The I-16s used on operational missions retained their wing guns. (Ivan Ivanov)

Constanta and the hydro-base at Mamaia. Several administration buildings were damaged, as well two German pontoons in the harbor of Constanta. All four I-16s landed safely at Odessa.

Between 10 and 13 August 1941, several attacks were flown against the Danube bridge at Cernavoda. With a length of 5,452 feet (1,662 m) it was one of the longest bridges in the world. It was a vital railway bridge and also housed an oil-pipeline that ran from Ploiesti to the harbor of Constanta. Previous attacks had shown that Ju 4s and Pe 2s could not bomb with the required accuracy to put the bridge out of action. On 10 August 1941, two *Zveno-6 SPBs* took off from Evpatoria and attacked the bridge. The pipeline and one bridge pier were damaged by the two bombs that hit the bridge. The attack was repeated on 13 August, with three *Zveno-6 SPBs*. When the first I-16s attacked the bridge they ran into heavy anti-aircraft fire. This attack caused little damage to the target, however a Flak position was destroyed killing four soldiers.

A further *Zveno* attack with four I-16s was launched on 17 August against Constanta. The target was three warships in dry dock. These were successfully attacked, but no damage report was recorded. The I-16s were intercepted by Romanian IAR 80 fighters of the 52nd Squadron, who shot down one of the I-16s.

One of the last *Zveno* missions was flown on 18 September 1941 against a bridgehead over the Dnieper river near Zaporozhye, in which the target was destroyed. This raid cut off the Wehrmacht from using the bridge to deliver vital supply over the Dnieper to the front.

*Zvenos* also fought in the defense of the Crimea. In early October 1941, three I-15s of the 8th Regiment and two TB-3 *Zvenos* with two I-16s bombed artillery positions near Armyansk in the Northern Crimea. Three batteries were destroyed by the Soviet force with no losses.

The last *Zveno* mission took place on 22 October, when two formations, together with eleven I-5s and eight I-15s, were to bomb a long range artillery battery and German troops near Perekop in Northern Crimea. Due to the strong Luftwaffe opposition, the I-16s disengaged from their TB-3 mother planes over Evpatoria and proceeded to the target on their

own. Over the target the I-16 fighters were met by heavy flak. The artillery battery was not located and the I-16s bombed German tank concentrations. This last attack was lead by Captain Arseny V Shubikov, who unfortunately was reported as missing in action during this raid.

During the war, more than thirty *Zveno* missions were flown. Due to their wartime exploits the 32nd Fighter Aviation Regiment was renamed the 11th Guards Fighter Aviation Regiment. The TB 3 4AM 34RN were transferred behind the Caucasus mountains based at Terekly Konrad airfield.

## Spanish I-16 Type 5s

Spain had become a Republic during 1931 and for the next two years the first elected government proposed reforms intended to bring the country into the modern world. During 1936,

A *Fuerza Aerea Republicana* (FARE) I-16 Type 5 nosed over on landing at El Carmoli Airfield during 1938. The aircraft is fitted with a trim tab on the flap, a modification not found on Soviet I-16 Type 5s. (Museo del Aire)



the Spanish politics. Left was dominated by the two general trade unions, the CNT influenced by the anarchism of Bakunin, and the UGT, which was Marxist but not Bolshevik. For the elections of February 1936, the Left came together, at the communists suggestion, in a Popular Front. Using this tactic, they gained 278 seats, of which the communists held seventeen.

On 18 July 1936, Nationalist factions under Generalissimo Francisco Franco rebelled against the democratic government of the Second Spanish Republic and, in late August, the Soviet Union elected to intervene actively in support of the Republican forces. The reaction of the Soviet Union was dictated more by its fear of the growth of the Nazis and their Anti-Comintern Pact with Italy, than by the opportunity to promote a communist government in Spain.

In August of 1936, the Soviet Union established diplomatic relations with Spain and sent an ambassador with a formidable staff. This staff included General Yan K Berzin who had just left his post as head of the GRU (Soviet Military Intelligence). He later played a major part in the defense of Madrid. Vladimir A Antonov Ovseenko, a leader of the October 1917 Revolution was appointed as Consul-General in Barcelona. Like so many other Soviet military advisors in Spain, both were later recalled to Moscow and subsequently executed.

The Commander in Chief of the Soviet air component in Spain was Colonel Yakob Shmushkevich, alias General Dougas. Due to his experience in Spain, he was appointed commander of the Red Air Force in September of 1939, but after the ill-fated Winter War against Finland, he was removed from this post and subsequently executed in October of 1941.

By late October of 1936, the first consignment of thirty-one I-16 Type 5s had arrived at the port of Cartagena. The nimble fighter was named by the Spanish Republicans the *Mosca* (fly). These fighters were used to form two fighter squadrons of the *Fuerza Aerea Republicana* (FARE), *la Escuadrilla de Moscas* (1st Mosca Squadron) which was based at Alcala de Henares and the *2a Escuadrilla de Moscas* (2nd Mosca Squadron) based at Camposoto.

On their first combat mission, 15 November 1936, I-16 Type 5s of the *1a Escuadrilla de Moscas* were engaged by three Fiat CR 32s, but the fight ended without loss to either side. This Republican I-16 Type 5, Black 35, was found abandoned by advancing Italian troops of the *Corpo Truppe Volontarie*. (Carlo Lucchini)





This captured I-16 Type 5 was given the code Black 1W-1, and was tested by the Nationalists at Cuatro Vientos Airfield. The two piece pitot tube was a local modification. (Museo del Aire)

The following day the *1a Escuadrilla de Moscas* shot down two Fiat CR 32s. During this time all the I-16s were being flown by Soviet pilots. On 17 November, an I-16 of 2a *Escuadrilla de Moscas* was shot down when the pilot made the fatal mistake of engaging in a close-turning dogfight with a highly maneuverable Fiat CR 32.

Mosca pilots quickly figured out that the best procedures for combating the Fiat CR 32. Their tactics consisted of a diving attack, using cloud cover to advantage. After making a single firing pass, they would climb back to altitude using the speed gained in the dive.

In December of 1936, the first I-16 Type 5, Black 9, was captured by the Nationalists. This *Mosca*, which was later repainted in Nationalist markings and coded 1W-1, was evaluated by a test group at Cuatro Vientos. For the flight tests the standard pitot tube was replaced by a two piece pitot tube.

The Nationalist generally referred to the I-16 by the nickname *Rata* (Rat) or Boeing because of its supposed American P-26A origin. By this time it was generally assumed in the Western Europe and America that the I-16 was built according to Boeing company specifications. But in fact, the I-16 was a generation ahead of the technology used in the Boeing P-26A.

In December of 1936, a further thirty-one I-16 Type 5s were delivered, these aircraft being used to form *3a Escuadrilla de Moscas* based at Albacete, which was committed into action in February of 1937. The Soviet Union had delivered a total of sixty-two I-16 Type 5s. By early 1937 at least four had been destroyed in combat and only twenty-four were reported as operational, while the rest were in varying stages of assembly.

The first non-Soviet pilots began to join the 1st and 3rd *Mosca* Squadrons in May of 1937. These men included such experienced fighter pilots such as the Spaniards Manuel Aguirre and Eduardo Claudio, and the Americans Frank Tinker and Albert Baumler. In mid-May the 3rd *Mosca* Squadron moved to the Northern Sector, making a direct flight from Algeti near Madrid to Bilbao. Of the twelve aircraft that began the mission, seven managed to accomplish the 186 mile trip, but five were forced to return.

By late June, there were only some fifty I-16s still airworthy. At least thirteen I-16 Type 5s had been lost in combat or in accidents. During the Battle of Brunete (6-28 July 1937) the I-16s had their first serious encounters with Messerschmitt Bf 109s.

The I-16 Type 5 had been decisive in gaining air superiority for the Republicans, at least over the Madrid region. From November of 1936 until the Summer of 1937 I-16s were the

superior fighter in Spain. This forced the Third Reich to send the Messerschmitt Bf 109 to Spain in order to regain air superiority over the nimble *Mosca*.

When sufficient numbers of the more advanced I-16 Type 6 and I-16 Type 0 arrived in Spain a number of the remaining I-16 Type 5s were allocated to the high speed fighter training camp at El Camoli near Cartagena.

## Chinese I-16 Type 5

On 7 July 1937, Japan begun its invasion of China, without a declaration of war. At the time of the invasion, the Chinese Air Force was a very mixed bag of foreign aircraft and was dependent on aircraft imported from distant countries.

A non-aggression pact had been signed between the Soviet Union and the Chinese Kuomintang Government on 21 August 1937 and under the terms of one of the secret clauses of the pact, the Soviet Union was to send military aid to China with an emphasis on the re-equipping the Chinese Air Force, which had been virtually annihilated by the Japanese.

During 1937, the first I-16 Type 5s had reached China and the 4th Fighter Group became the first Chinese unit to operate the I-16. This unit converted from the American Curtiss Hawk II biplane fighter, which had been delivered in March of 1936.

Six I-16 Type 5s of the 4th Fighter Group, led by Colonel Kao, had just arrived from Ankang on 21 November 1937 and were being refueled at Chouchiakou airfield in Honan when ten Mitsubishi G3M2 bombers appeared overhead. Colonel Kao was killed when his fighter was among those destroyed on the ground during the bombing. Eleven bombers came back to the same airfield the next day, but this time three I-16 Type 5s were on patrol and a single Mitsubishi G3M2 was shot down.

On 22 November 1937, Soviet fighter pilots scored their first victory. Twenty-three I-16 Type 5s were based at Nanking airfield and under the command of Captain G.M. Prokoviev. Six Japanese Type 96 fighters engaged six of the I-16 Type 5s and a Type 96 flown by Miyazaki was lost. Japanese forces returned to Nanking with nine Mitsubishi Type 96 fighters, six Aichi Type 96 dive bomber and two Mitsubishi G3M2 bombers on 24 November 1937 and according Japanese sources, three of the six intercepting I-16 Type 5s were shot down.

As Japanese forces moved towards the capital city in December of 1937, Nanking was the site of repeated combats. Eight Yokosuka B4Y1 attack biplanes escorted by six Mitsubishi Type 96 fighters from the 13th Air Group attacked on 2 December 1937 and the I-16s rose to intercept. The Japanese fighters claimed they downed a number of I-16s without loss.

Chinese I-16s were camouflaged in standard Soviet colors, Olive Green uppersurfaces and Light Blue undersurfaces. The national markings were only carried on the wing undersurfaces, not on the wing uppersurfaces. The White Blue horizontal stripes were applied to the rudder.

# I-16 Type 6

The I-16 Type 6 replaced the I-16 Type 5 on the production line at GAZ-21 and GAZ-153 and, when the production of the I-16 Type 5 and Type 6 was phased out in late 1937 some 2,200 examples of both versions had been built, with one third of them being I-16 Type 6s.

One of the shortcomings of the I-16 Type 5, in the opinion of many average pilots, was the enclosed cockpit and in operational service most Soviet pilots flew with the canopy pushed to the front.

As a result, to answer pilot's complaints, the Polikarpov Design Bureau returned to the open cockpit and replaced the forward sliding canopy with a fixed, single piece windscreen which provided the pilot with a far better overall view. The OP-1 gunsight was retained. Another change from the I-16 Type 5 was the introduction of an improved 730 hp M-25A engine.

During its production run, a number of small changes were introduced to the I-16 Type 6. The OP-1 gunsight was replaced by a more advanced PAK-1 (*Prizel Aviazionnyj Kollimatoryj/Aviation Collimator Gun sight*) which was a copy of the French Clair gunsight. PAK-1 equipped I-16 Type 6s could be identified by the fact that barrel of the OP-1 protruding through the windscreen was deleted, since the smaller PAK-1 was housed behind the windscreen. The PAK-1 became the main type of gunsight used on all I-16 variants from the I-16 Type 6 onwards.

Late production versions of the I-16 Type 6s had a trim tab on the inner portion of the flaps and a number of early Type 6s were retrofitted with this modification in the field.

The I-16 Type 6 could also be equipped with a gun camera mounted on the fuselage dorsal spine behind the cockpit. Since the gun camera was retrofitted to a number of earlier variants,

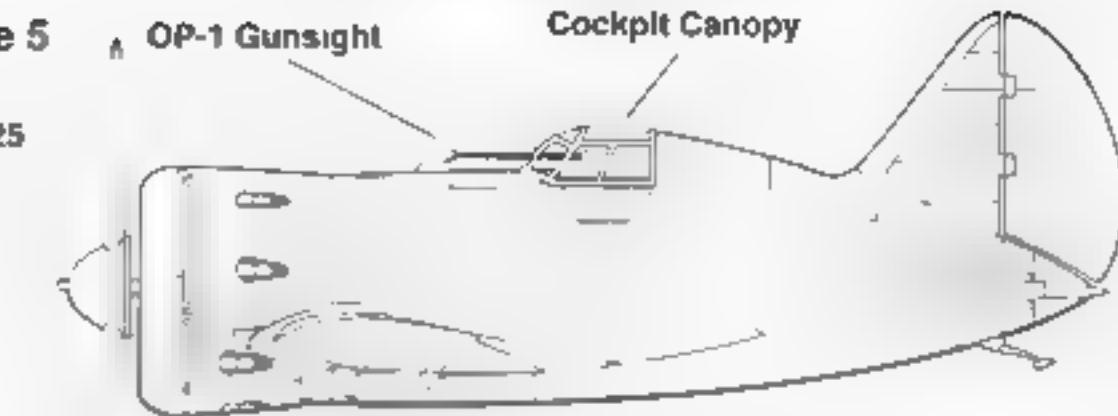
This damaged I-16 Type 6, White 29, was loaded into a truck for transport back to a repair depot. The aircraft carried a two tone Dark Green, Olive Green uppersurface camouflage. The fuselage star had a thin black outline. (Robert Bock)



## Fuselage Development

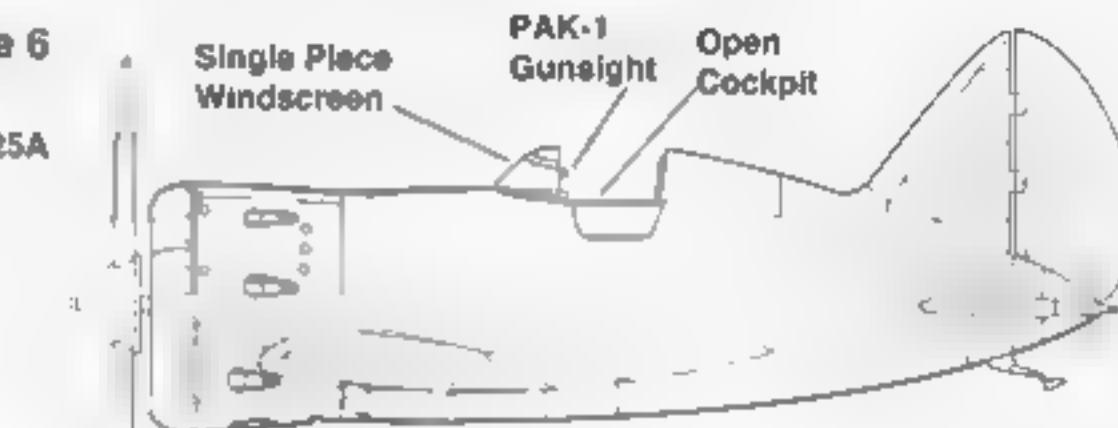
### I-16 Type 5

700 hp M-25 Engine



### I-16 Type 6

730 hp M-25A Engine



the presence of a gun camera is not an identification feature of the Type 6.

For winter operations, the I-16 Type 6s could be equipped with skis landing gear. Like earlier variants, the landing gear was fixed in the lowered position when skis were fitted.

The armament of the I-16 Type 6 was the same as the earlier I-16 Type 5, two ShKAS 7.62mm guns. Before the Il-2 became available in quantity, I-16 Type 6s used in the ground support role. Many ground attack Type 6s had the propeller spinner deleted, however, this was not a standard feature. For ground attack duties the I-16 Type 6 could be armed with either four or six Type R-82 rocket rails under the wings for RS-82 unguided air-to-ground rockets. The RS-82 had a 1.28 pound (.585 kg) warhead and a range of 5.686 yards (5.200 meters).

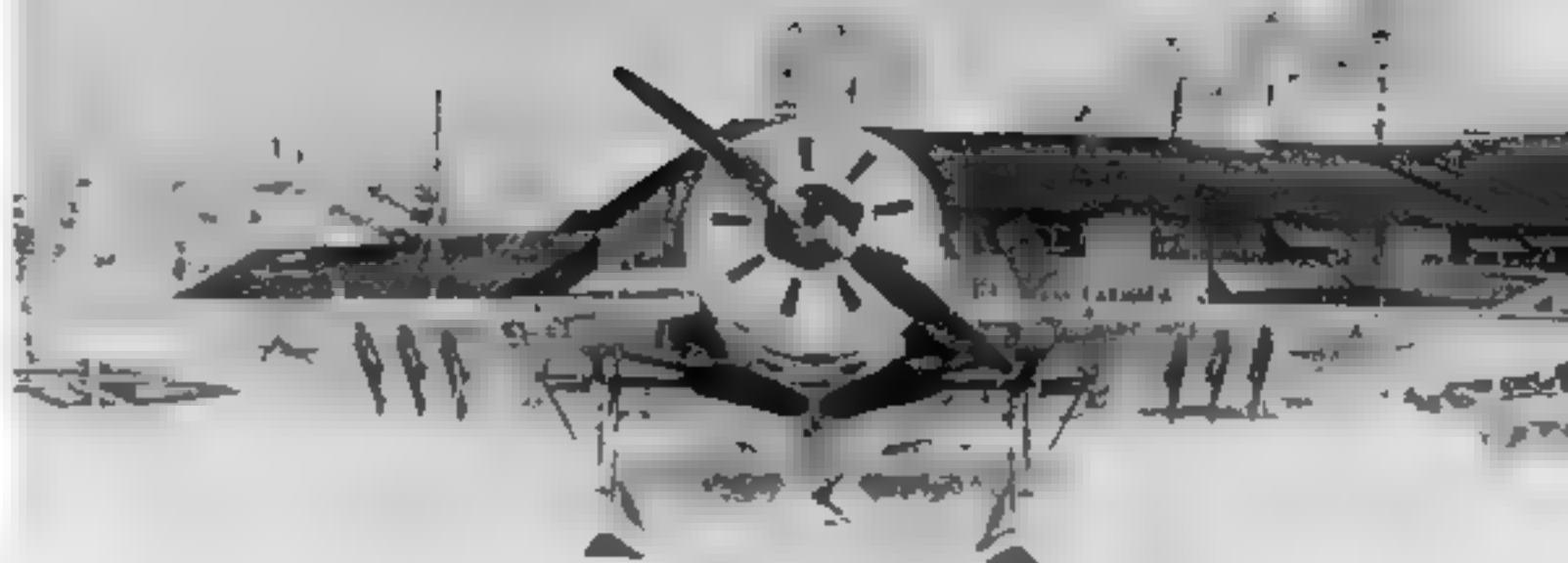
I-16 Type 6s left the production lines painted in Olive Green uppersurfaces and Light Blue undersurfaces. The Red star national markings had a thin black outline and was carried on the rear fuselage and both the wing upper and undersurfaces. In most cases a single digit tactical number applied to the tail.

After the start of the Second World War (Great Patriotic War), a number of I-16 Type 6s used by front-line units were repainted in a two tone camouflage on the uppersurfaces. In many cases a Dark Green color was added on the existing Olive Green. The Red star was added to the rudder and deleted from the wing uppersurfaces. The tactical number was most often carried on the fuselage, however there were no strict guidelines for camouflage and markings during in the first months of the war.



This pair of I-16 Type 6s were used in the ground attack role armed with rockets. The aircraft in the foreground is outfitted to carry six rockets while the aircraft in the background is configured to carry four. Both aircraft have had the landing gear doors and propeller spinners deleted. The engine cowling was in Black and the tactical number was in White. (Robert Bock)

This I-16 Type 6, Red 15, carries White winter camouflage. The skis have been fitted with aerodynamic fairings to cut down on their drag. The aircraft is outfitted with six RO-82 rocket rails for RS-82 air-to-ground unguided rockets. (Keski-Suomen Ilmailumuseo via Hannu Valttonen)



This starboard underwing star is much smaller than the star under the port wing. The cowling cooling shutters are partially open to help bring the engine up to proper operating temperature more quickly in the cold. (Keski-Suomen Ilmailumuseo via Hannu Valttonen)

Over the course of the Second World War (Great Patriotic War) most I-16 Type 6s were given a two tone上下表面 camouflage scheme of Dark Green and Olive Green. The Red star on the fin was larger than normal and the aircraft also carries a Red star outlined in White and Black on the spinner. The fairing on the dorsal spine behind the cockpit is a gun camera installation. (V. Simecak)

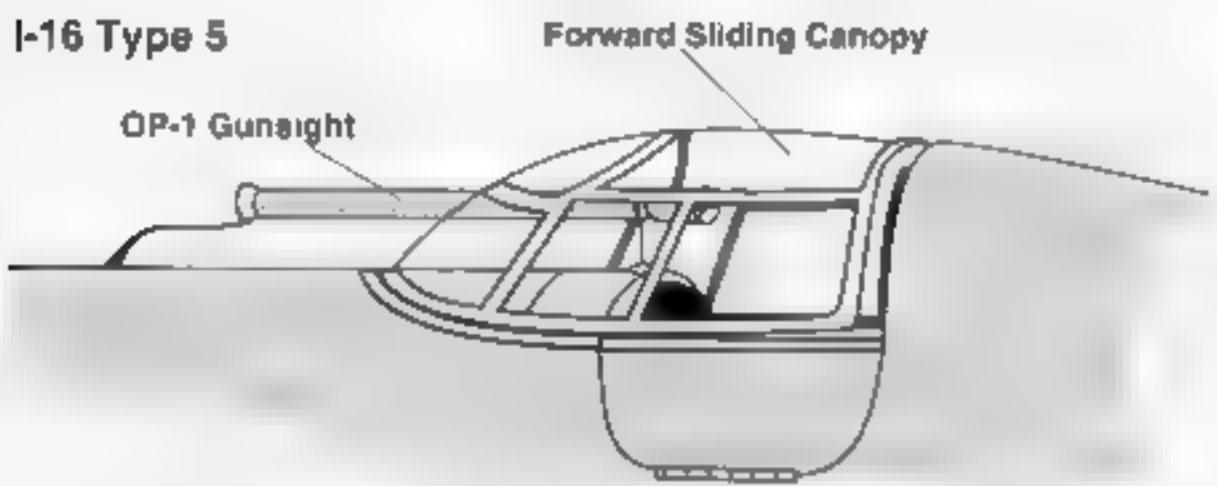




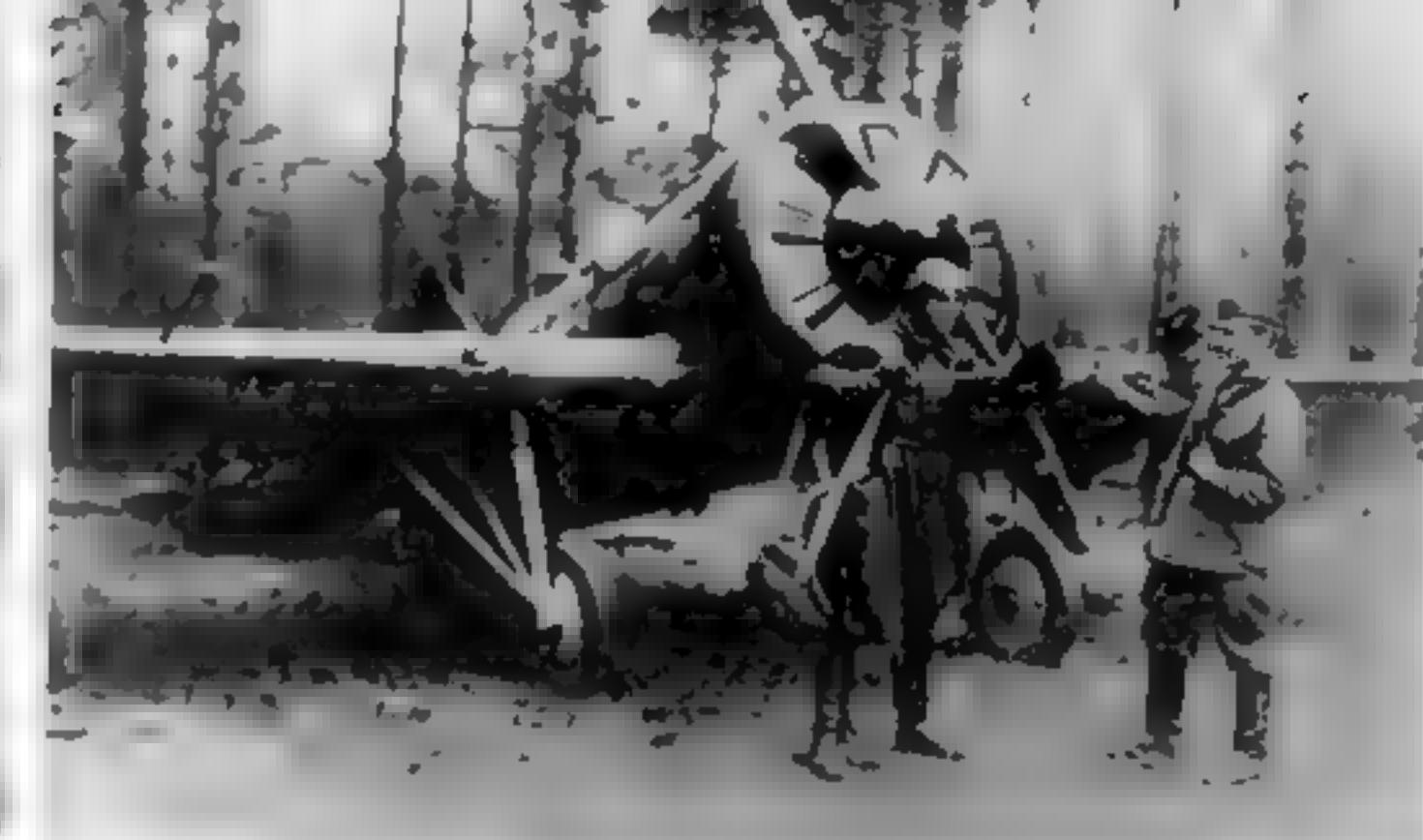
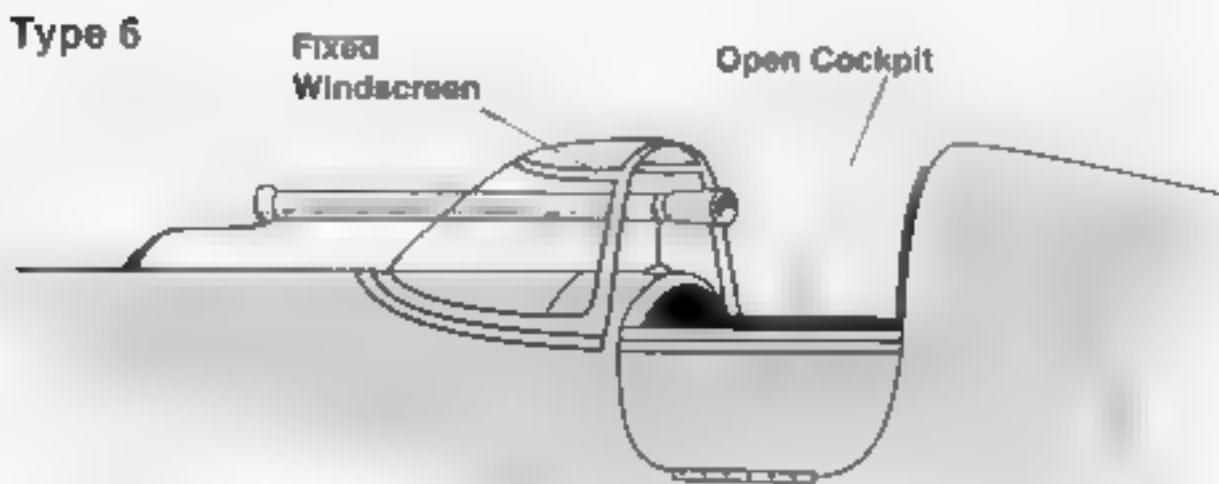
Ground crewmen use a Hucks starter truck to start the engine of this I-16 Type 6, White 50, of the Baltic Fleet during August of 1941. The aircraft is armed with underwing rockets. (V. Simecek)

## Canopy Development

I-16 Type 5



I-16 Type 6



A Soviet pilot discusses an upcoming ground attack mission with his ground crew. His I-16 Type 6 was armed with four underwing rockets and has had the landing gear doors removed. This was a common practice for aircraft operating from unprepared forward airfields. (G. F. Petrov)

During the early days of Operation BARBAROSSA, the German Invasion of the Soviet Union, a great number of Red Air Force aircraft were captured intact, including this early production I-16 Type 6, Yellow 3. In order to render the fighter non-operational, the Germans removed the OP-1 gunsight from the cockpit. It was common for Soviet fighters to carry the Red star insignia on the wing uppersurface, prior to the start of the war. A short time after the war broke out, the star was deleted from the wing uppersurface. (ECPA)





This late production I-16 Type 6 was captured by Rumanian troops during their quick advance toward Odessa on the Black Sea during the opening days of the invasion of the Soviet Union. The aircraft has had the wing guns removed and the pilot was broken. (Dan Antoniu)

The wing gun bays are open on this I-16 Type 6, Yellow 13, and the two ShKAS 7.62mm machine guns have been removed from the aircraft also has had the main landing gear doors removed along with the upper cowling panel. The aircraft in the background is a I-152 fighter biplane. (Dr. Volker Koos)



A line-up of *Moscas* of the High Speed Fighter School at El Carmoli Airfield. The aircraft in the foreground is an I-16 Type 6, while the remainder are I-16 Type 5s. All aircraft have had the main landing gear doors removed. (Juan Arreaz Cerdá)

## Spanish I-16 Type 6

The first delivery of thirty-one I-16 Type 6s arrived in Spain in two lots, seventeen on 21 May 1937, aboard the freighter ANTONIO SATRUSTEGUI and fourteen on 8 July aboard the CABO SANTO TOMI. After their arrival in the Spanish port of Alicante these I-16s were all assembled at Archena. The I-16 Type 6 was used to form the *4a Escuadrilla de Moscas* (4th *Mosca* Squadron) and to replace losses in the other I-16 units.

In late August of 1937, six I-16 Type 5s and I-16 Type 6s had been lost in combat in the North, with only eight remaining airworthy. Seven more were lost in the North and two in the Center during September.

By the beginning of October, there were fifty-one *Moscas* in an airworthy condition between the Central and Northern Sectors. During this same time two additional units, the *5a Escuadrilla de Moscas* and *6a Escuadrilla de Moscas* were formed. Also in October 1937 three additional *Moscas* were shot down over the Northern Sector and another was lost over the Central front. In addition, four were captured and one I-16 pilot defected to France. As of December 1937, only forty-eight *Moscas* of all types remained were airworthy in the *Fuerza Aérea Republicana* (FAR) and, as a result, the *6a Escuadrilla de Moscas* was deactivated.

When sufficient numbers of the more advanced I-16 Type 10 arrived in Spain, a number of the surviving I-16 Type 6s were transferred to the high speed fighter training camp at El Carmoli near Cartagena. During training operations, most I-16 Type 6s had the main wheel covers removed.



# Chinese I-16 Type 6

Along with the I-16 Type 5, a number of early I-16 Type 6s were also delivered to China in October of 1937. These early production I-16 Type 6s were still equipped with the OP-1 gunsight adopted from the I-16 Type 5. About 450 Soviet pilots and technicians assembled via train at Alma Ata in Kazakhstan. They were to deliver the first of 225 Soviet aircraft to China. These included: 115 fighters, a number of which were I-16 Type 5s and I-16 Type 6s, sixty-two bombers and eight advanced trainers. These supplies were trucked into China over the old silk road to the end of the Chinese railway line at Lanchow.

Together with the I-16 Type 5, the I-16 Type 6 saw considerable combat against Japanese Army and Navy bombers and their escorting fighters. On 18 February 1938, fifteen Japanese bombers with an escort of eleven Mitsubishi A5M fighter attacked the Wuhan (Hankow) area. Nineteen I-152s and ten I-16s of the 4th Fighter Group intercepted the attackers. Admitted losses for the engagement included four Japanese and five Chinese fighter pilots killed in action, including the 4th Fighter Group commander.

Nanchang was the target of thirty-five Mitsubishi G3M2 bombers and eighteen A5M fighters on 25 February 1938. These were met by nineteen I-152s and eleven I-16 Type 5s and I-16 Type 6s. A single Polikarpov fighter was shot down while another four were damaged. During the first two months of 1938, defending Chinese fighters flew 250 sorties on twenty-seven defensive missions, admitting the loss of thirty-one aircraft and twenty-two pilots, while claiming thirty Japanese aircraft destroyed.

An early production I-16 Type 6 supplied to the Chinese Air Force. Early production Type 6s retained the OP-1 gunsight used on the Type 4 and Type 5. The lower folding portion of the main landing gear door has been removed. The cowling and propeller spinner of were painted Black. (San Diego Aerospace Museum via Ray Wagner)



# Finnish I-16 Type 6

In October of 1939, anticipating war with Nazi Germany, Stalin and the Soviet Foreign Minister Vyacheslav Molotov pressed the Finns to cede to the Soviet Union a strip of southern Finland. This land was to serve as a buffer and protect the approaches to Leningrad. Negotiations reached an impasse and on 30 November 1939, the Soviet Union invaded Finland.

The Soviet effort began with visions of a quick victory, but soon the Soviet military found itself stalemated as the Finns displayed fierce resistance. The Finnish Army, numbering a mere 200,000 soldiers, held on under heavy Soviet pressure.

By 12 March 1940, the Finns could no longer hold out and ceded the buffer zone they wanted. Losses for the Soviet Air Force, however, during the 104 days of combat were enormous. Between 700 and 900 aircraft were lost and the Red Army reported that some 48,748 soldiers were killed in action.

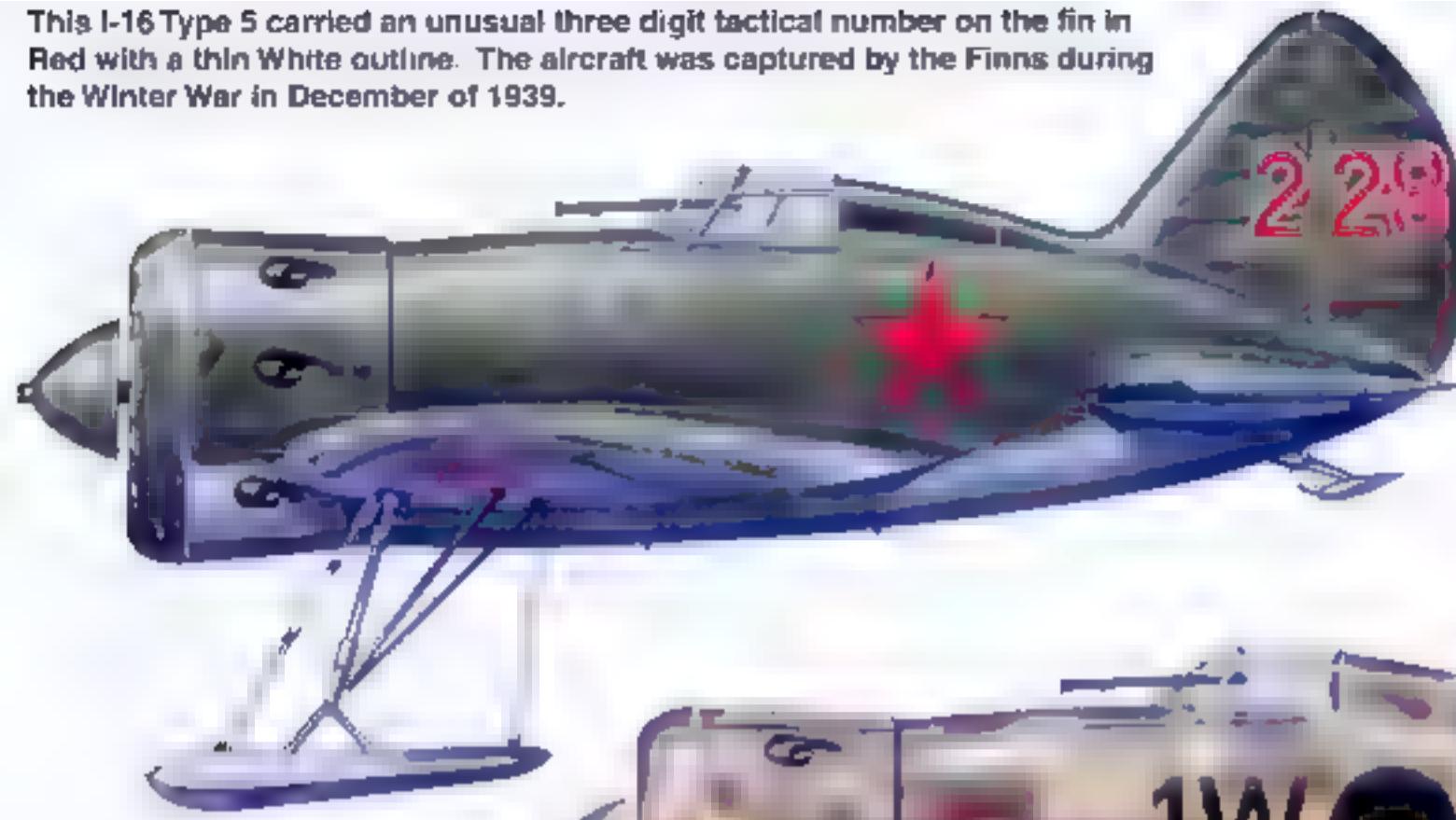
On 25 June 1941 following the German attack to the Soviet Union, Finland declared war on the Soviet Union and advanced to the old 1939 frontier on the Karelian Isthmus. In response, the Soviet Air Force bombed Turku in three waves of forty aircraft. With this event, the Continuation War between the Soviet Union and Finland started. In spite of a strong German presence, the Finnish Army only carried out military operations that were in their interests.

During the Continuation War with the Soviet Union, there were five I-16 of various sub-types captured by the Finns, but only one was in airworthy condition. This I-16 Type 6, Red 15, was in White winter camouflage with Light Blue undersurfaces when it was captured intact at Siurasaari on 28 March 1942. It was previously used by the Red Air Force for ground attack duties and carried three R-82 missile racks under each wing. This I-16 Type 6 was

Black IR-01 was an I-16 Type 6 captured by the Finnish Air Force on 28 March 1942. It was repainted in Finnish camouflage and markings including Yellow bands around the nose, and fuselage. Additionally, the undersides of the wingtips were also Yellow. The aircraft was based at Römpölli during March of 1943. (Keski-Suomen Ilmailumuseo via Hennu Veltosen)



This I-16 Type 5 carried an unusual three digit tactical number on the fin in Red with a thin White outline. The aircraft was captured by the Finns during the Winter War in December of 1939.



The Spanish Nationalists captured this I-16 Type 5 during 1936 and tested it at Cuatro Vientos Airfield under the serial 1W-1



This ski equipped I-16 Type 6 was captured by the Finns on 28 March 1942 and repainted in full Finnish Air Force markings.



German troops captured this I-16 Type 10 early in their invasion of Soviet Union. The aircraft carried a highly unusual unit marking on the fin.



An I-16 Type 10 flown by a training unit during 1944. By this time most surviving I-16s were in second line duties.

I-16 Type 10s were numerically the most important fighter in the Chinese Air Force.



This I-16 Type 18, White 91, had the main landing gear wheel doors removed for Winter operations.



An I-16 Type 27 of an unidentified fighter regiment during the Summer of 1941. The lightning bolt on the tail is believed to have been a regimental marking.



The Royal Rumanian Air Force used this I-16 Type 29 in mock combats to train their pilots in the best way to combat the I-16.

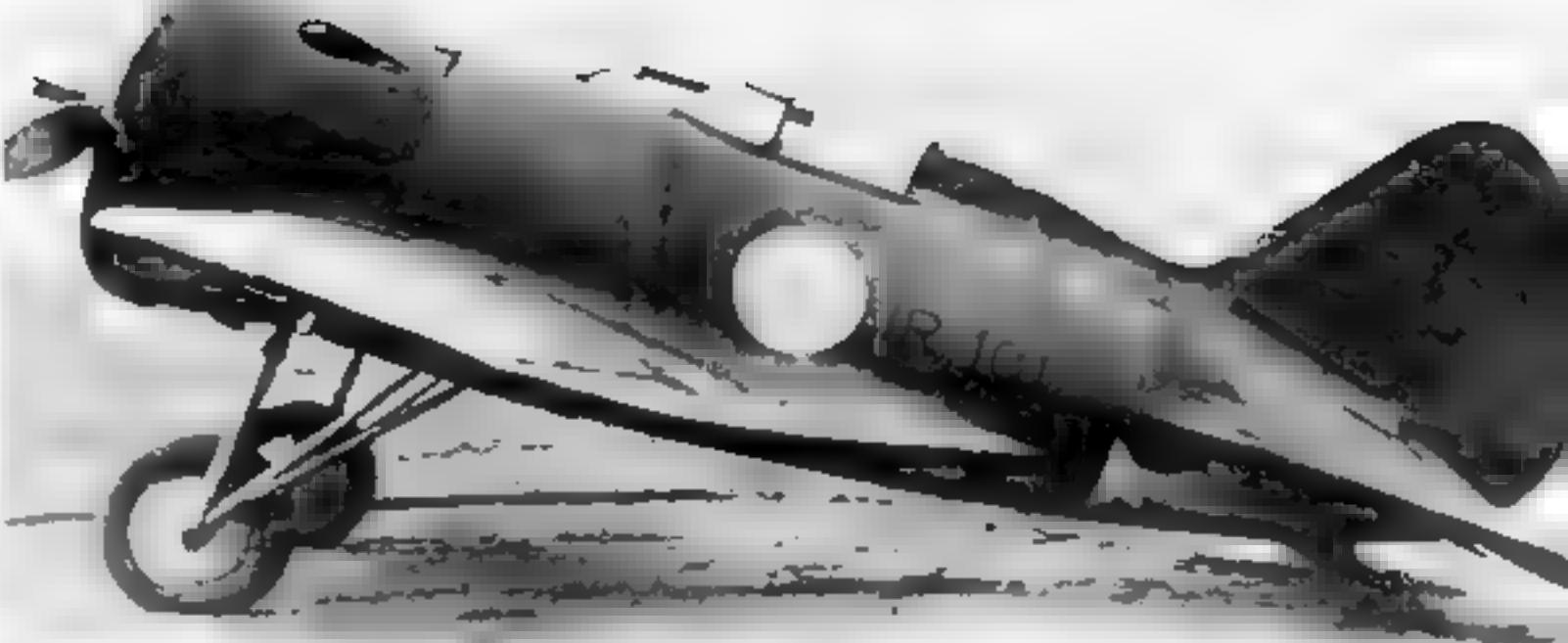


The Luftwaffe used a number of captured UTI-4s in the training role. This aircraft later crashed outside Rechlin.

unusual in that it carried a larger Red star under the port wing than under the starboard wing.

The I-16 Type 6 was repainted with Finnish camouflage of Olive Green and Black Green uppersurfaces, with a Yellow recognition stripe on the nose and on the rear fuselage. The serial IR-101 was assigned to the aircraft and was painted on the fuselage in Black. Due to the fact that the I-16 Type 6 was captured with a fixed ski landing gear, the landing gear could not be re-raced even though a wheeled landing gear from captured stocks was installed (no wheel covers were installed) and the tail skid was replaced by a tailwheel. On 1 August 1942, the aircraft was assigned to *Lentolaivue 6* and on 16 November of that same year, the fighter was transferred to *Lentolaivue 30*. On 22 June 1943, the I-16 Type 6 was placed in storage after having flown only six hours and thirty-five minutes with the Finnish Air Force.

(Right) Later in its service with the Finnish Air Force, IR-101 was given a wheel landing gear and had the original tailskid replaced by a tailwheel. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)



Black IR-101 shortly before it was given a wheel landing gear and had the original tailskid replaced by a tailwheel. At this time the aircraft was assigned to *Lentolaivue 30* and had flown a total of six hours thirty-five minutes at Nylng (now SWN) in 1942. (Pekka Saarinen (Klaus Niitala))



# I-16 Type 10

Combat experience in Spain revealed that the fire power of the I-16 Type 5 and I-16 Type 6's two ShKAS 7.62MM machine guns was rather inadequate for modern combat. This shortcoming led to the I-16 Type 10, which was, in total numbers of aircraft produced, the most important variant of the I-16 fighter series.

In order to improve the fire power of the I-16, a pair of synchronized ShKAS 7.62MM guns with 650 rounds per gun, were installed in the upper nose finning through the propeller. The machine gun muzzles were visible protruding through the cowling lip.

Additionally two fairings were added to the upper nose to cover the gun breech installation and a small blister was placed to the left of the port gun and to the right of the starboard gun fairing. The machine gun fairings and the small blisters were quick identification features for the I-16 Type 10 when compared with the I-16 Type 5 and Type 6 versions.

Most I-16 Type 10s were equipped with the PAK-1 gunsight, but late production aircraft received the more advanced PAK-1a and PAK-1m versions of this gunsight.

The conversion from the I-16 Type 6 to the new Type 10 at GAZ-21 was done in a remarkably short period of time. In a letter issued on 25 December 1937, Kliment E. Voroshilov, chairman of the Red Air Force, stated the urgent need to convert the production line at GAZ-21 from the I-16 Type 6 to the more advanced I-16 Type 10. Factory director Y M Miroshnikov replied that such a conversion was planned within a year. Voroshilov and the Commissars replied that the deadline for conversion was two days!

In the event, the task was carried out by New Years Eve of 1938. On that day, the first I-16 Type 10 with four machine guns conducted its first static test firings. On 11 January, the first prototype built at GAZ-21 was test flown by S. Suprun and by March of 1938 thirty-one I-16 Type 10s were taken off the production line and shipped to Spain.

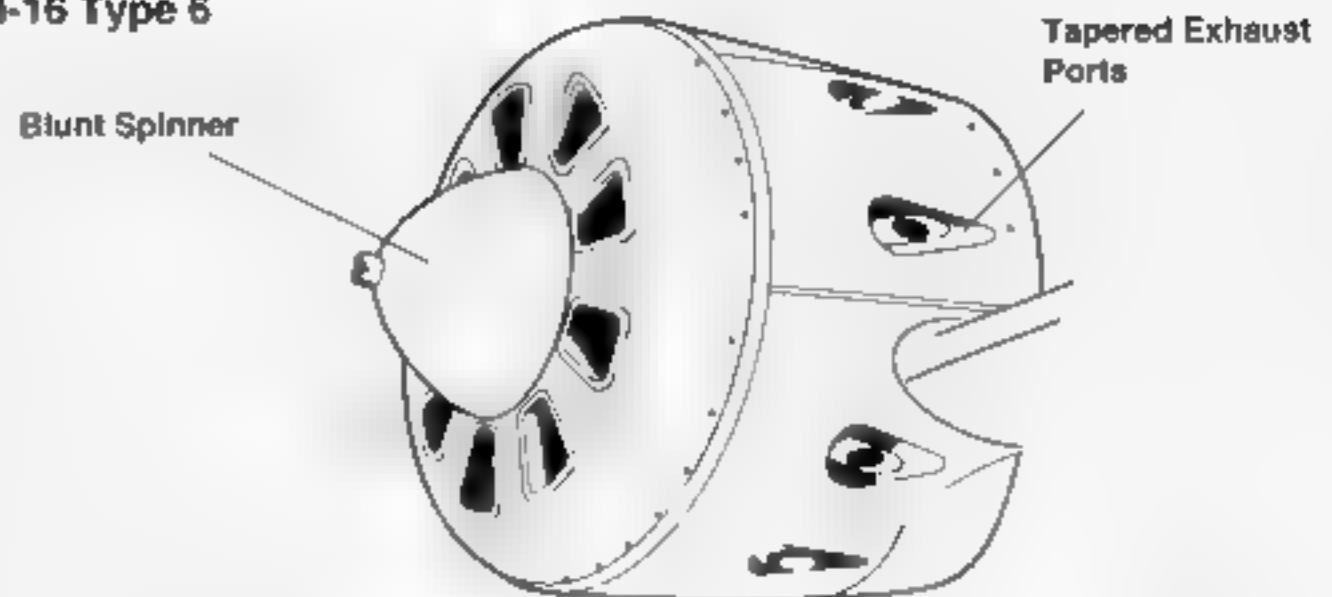
The I-16 Type 10 also differed from the earlier variants in the shape of the exhaust ports on the engine cowling. On the I-16 Type 5 and Type 6 these were large, tear drop shaped openings, but the I-16 Type 10 and all subsequent production models onward, these were replaced by smaller openings with a more rounded rear section. This modification became necessary since the initial configuration had allowed carbon monoxide to enter the cockpit.

The internal structure of the I-16 Type 10 was strengthened. Also standard in the I-16 Type 10 was a cable-cutter for the pilot. Previous operations with the I-16 showed that the landing

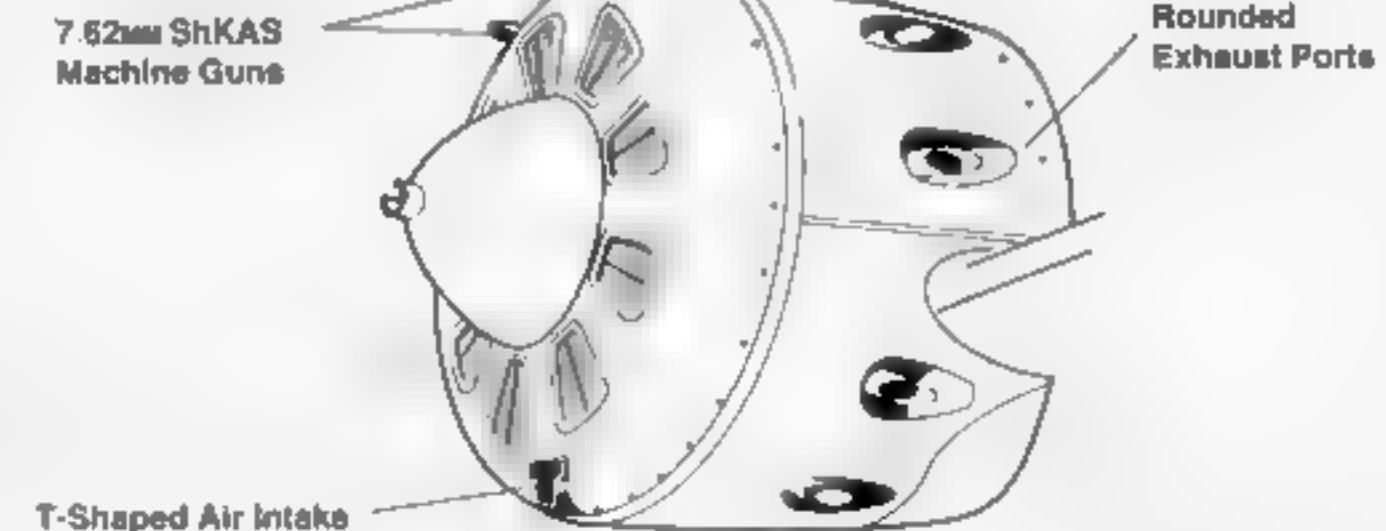
The I-16 Type 10 was the first variant of the I-16 series to be equipped with a retractable ski landing gear. The top speed of a ski equipped fighter was only slightly reduced from that of a standard I-16 Type 10. The barrels of the nose mounted machine guns are visible protruding from the cowling lip. (Yefim Gordon)

## Cowling Development

### I-16 Type 6



### I-16 Type 10



T-Shaped Air Intake

gear could easily become stuck in partly-retracted position. In order to eliminate the high number of crash landings this caused, the pilot was provided with a cable cutter. In order to decrease landing speeds, pneumatic flaps were fitted, which, when compared with the I-16 Type 5 and Type 6, were considerably reduced in size. Most of the I-16 Type 10 were equipped with a small trim tab on the flaps, however, most early production I-16 Type 10s did not have this trim tab. During operation, the new flap system proved to be extremely dangerous. Driven by a compressed air cylinder, they abruptly deployed and acted like a speed brake. As a result, they were dangerous for novice pilots and in operational service, were seldom used.

The I-16 Type 10 also saw the introduction of a flat, 8MM section of armor plate mounted behind the back of the headrest in the cockpit. This extra protection was introduced after combat experience in Spain. The armor was sufficient to stop the Breda 12.7MM shells of the Fiat CR 32.

Early production models had adopted the M 25A engine as well the front engine cowling from the I-16 Type 6, but most I-16 Type 10s were powered by the more advanced M-25V. This engine had a new K-25-4D carburetor and some minor internal improvements. Take off





This Winter camouflaged I-16 Type 10 has a Black engine cowling and Olive Green wing uppersurfaces. This aircraft may of had a replacement rudder from another aircraft that carried a small Red star. The fairings over the nose mounted machine guns are visible forward of the cockpit. (Mariusz Zimny)

power was increased from 635 hp to 775 hp, while the empty weight rose from 959 pounds (435 kg) to 1,012 pounds (459 kg) for the M 25V. Aircraft with the M-25V engine could be identified by a small 'T' shaped air intake on the lower nose under the spinner.

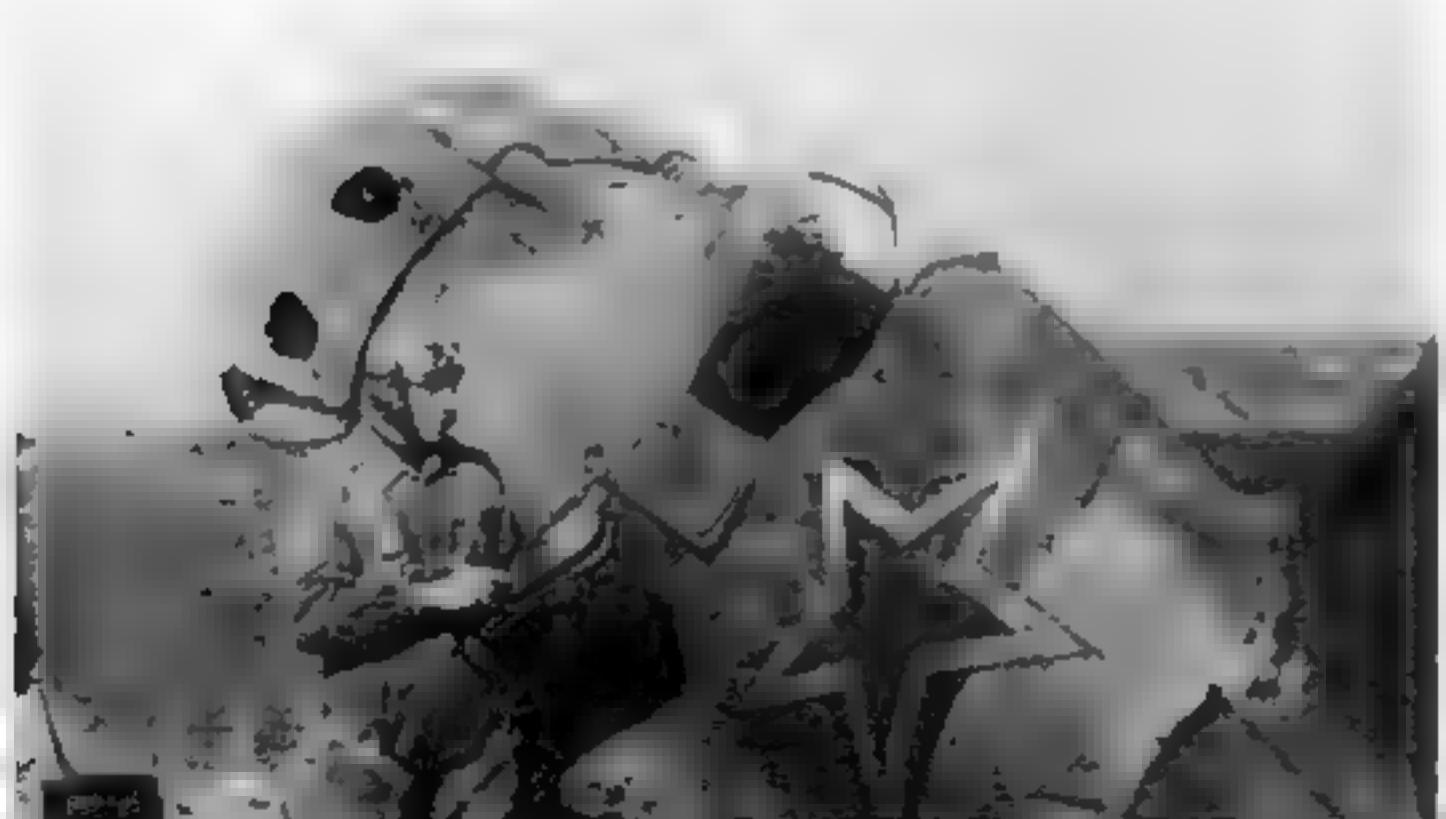
The I-16 Type 10 was the first variant to be fitted with a retractable ski landing gear. In the Red 4 was used as a liaison aircraft. The large Red star with thick White outline indicates this aircraft was in service during 1940. The aircraft also carried a Yellow identification band around the rear fuselage. (Vaclav Simecek)

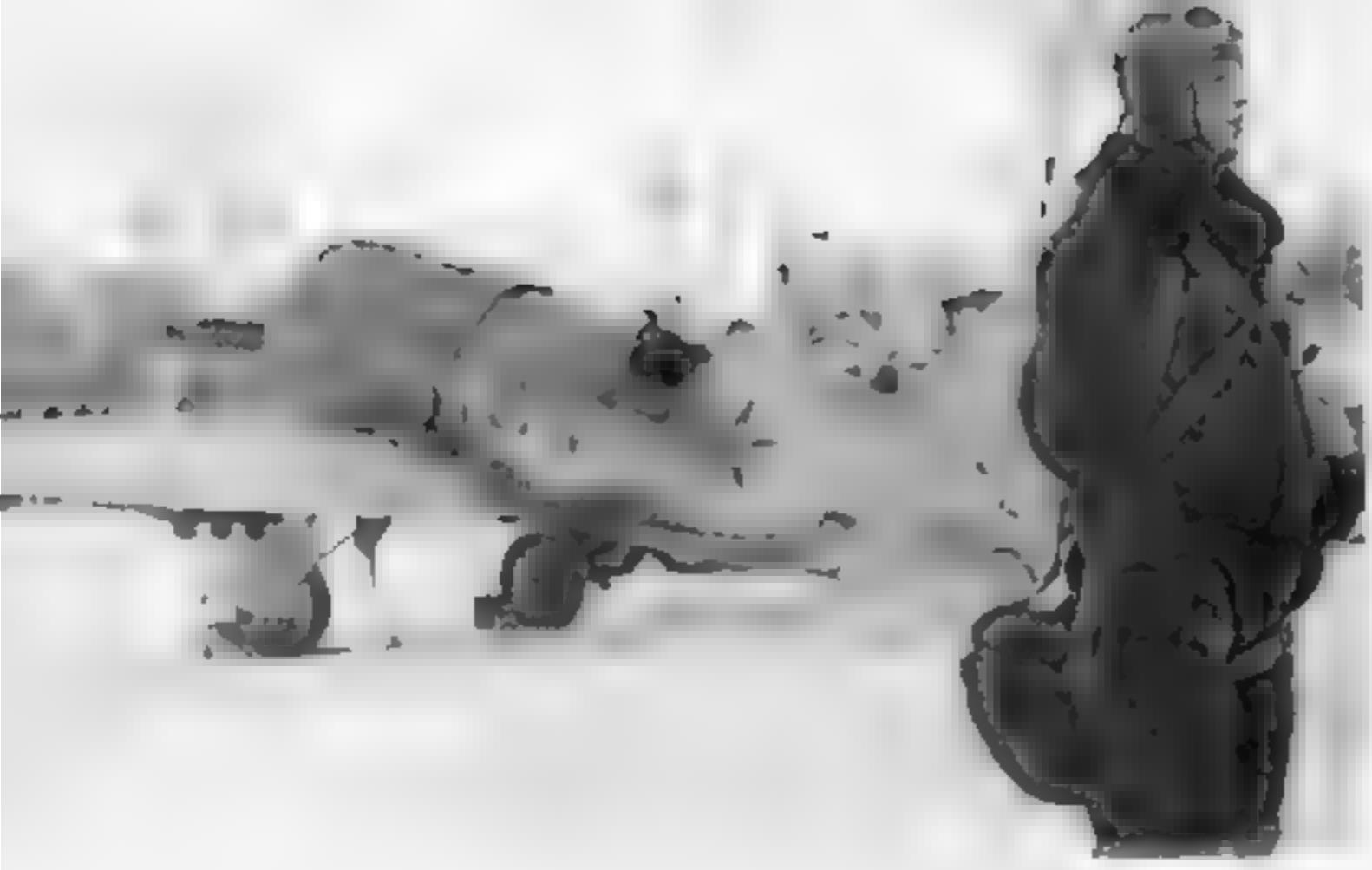


Pilots of the 5th Fighter Aviation Regiment are briefed for their next mission next to an I-16 Type 10 during the Summer of 1940. (G F Petrov)

retracted position they folded close to the wing center section, almost flush with its surface. The skis were fitted with shock absorbing cylinders, placed between the ski base and the ski mounting. One disadvantage was that the ski landing gear was heavier than the wheel configuration. When the retractable skis were used on the I-16 Type 10 and the subsequent versions a hole had to be cut in the lower half of the engine cowling in accommodate the skis in the

An I-16 Type 10 of the Baltic Fleet is prepared for another mission during August of 1940. The use of the Red star on the upper wing dates this as being pre-invasion. The use of the upper wing insignia was discontinued during the Summer of 1941. (G. F. Petrov)





A line-up of I-16 Type 10s of the 4th Guards Fighter Aviation Regiment in Winter camouflage in early 1942. The aircraft in the foreground was Red 34, followed by Red 75. Red 34 was armed with six AS-82 rockets. (G. F. Petrov)

This White I-16 Type 10 was overpainted with Olive Green and had an unusual unit insignia on the fin. It was captured by the Germans during June of 1941. The PAK-1 gun sight is visible just behind the wind screen. (ECPA)



A pair of Hungarian troops pose with an I-16 Type 10 shortly after it was captured during June of 1941. The aircraft was modified with a camera under the starboard wing tip for reconnaissance duties. White 4 was fitted with an AV-1 propeller (George Punka) retracted position. Flying characteristic of the ski version was similar to those of the wheeled versions.

Late production I-16 Type 10s had an AV-1 propeller installed in place of the standard V-25 propeller. Externally the modification was identifiable by the use of a larger propeller spinner. This propeller became standard on the I-16 Type 18. The older V-25 propeller of the standard I-16 Type 10 could only change pitch while on the ground, while the AV-1 pitch could be changed hydraulically by the pilot during the flight. When the spinner was removed, the AV-1 propeller could be distinguished by two round balance weight on the propeller hub.

A number of I-16 Type 10 were equipped with a camera mounted on the starboard wing tip for use as fast reconnaissance aircraft. This conversion was done as a field modification and was not only limited to the I-16 Type 10, but a number of late I-16 variants (Type 18s, Type 24 and Type 28) were also converted for reconnaissance duties. The armament of four ShKAS 7.62MM guns was retained.

During the rough field operations, the main landing gear doors were sometimes removed from the aircraft in order to avoid damage.

## TsKB-12P

The TsKB-12P was a modified variant of the I-16 Type 10, powered by an imported Wright-Cyclone SGR-1820-F-3 and only a single prototype was produced. The TsKB-12P differed from the standard production I-16 Type 10 in its armament. The aircraft was modified by having the two wing mounted two ShKAS machine guns replaced by two 20MM ShVAK cannon with 150 rounds each. Further tests with the TsKB-12P were carried out including a modification with four 20MM ShVAK cannons.



The I-16TK was based on the I-16 Type 10 airframe modified with two TK-1 turbosuperchargers, one on either side of the cowling. This installation made it necessary to delete the wing machine guns to save weight. (Ivan Ivanov)

## I-16TK

The I-16TK was developed from of the I-16 Type 10 with the intent of improving the high altitude characteristics of the fighter. The I-16TK was powered by an M-25V power plant equipped with two TK-1 turbosuperchargers developed by the Central Aero Engine Institute (TsIAM). To save weight, the I-16TK had the wing mounted machine guns deleted.

The I-16TK had the exhaust stubs placed on each side of the engine cowling replaced by a two stage supercharger on each side of the cowling. In front of the TK-1 turbosupercharger a row of air intakes was placed around the engine cowling. In addition, a large air intake was placed on each side of the upper engine cowling. A large heat resistant steel panel was mounted behind the TK-1 turbosupercharger exhaust. The aircraft was fitted with an AV-1 propeller without a spinner and the landing gear was strengthened to handle the increased weight.

The I-16 Type 20 was an experimental variant of the I-16 Type 10 fitted with two 52.8 gallon underwing fuel tanks. These tanks gave the fighter a range of some 745 miles. (A. A. Zimov)

During operation, both TK-1 turbosuperchargers were switched on simultaneously. During flight testing the I-16TK reached 106.9 mph (494 km/h) at 28,215 feet (8,600 m), the maximum ceiling obtained was 36,089 feet (11,000 m), which was a considerable boost in performance when compared with the standard I-16 Type 10, which had a maximum speed of 278 mph (448 km/h) at 10,367 feet (3,160 m) and a maximum ceiling of 27,099 feet (8,260 m). As more powerful M-62 and M-63 power plants became available, the I-16TK program was phased out. There was only one I-16TK built.

**I-16 Type 20**

The I-16 Type 20 was an experimental version of the production I-16 Type 10 built to test the concept of extending the fighter's range with auxiliary fuel tanks. This experimental version differed from the standard I-16 in having provisions to carry two 52.8 gallon (200 liter) slipper-type auxiliary fuel tanks under the wings which increased the maximum attainable range to about 745.6 miles (1,200 km). Standard I-16 Type 10s had no provision for 'wet' points in the wings. A I-16 Type 20 was tested in the Winter of 1937, this overall Silver test-bed carried no armament or gunsight and the rear portion of the nose gun fairings were removed. It was also equipped with modified main landing gear wheel covers.



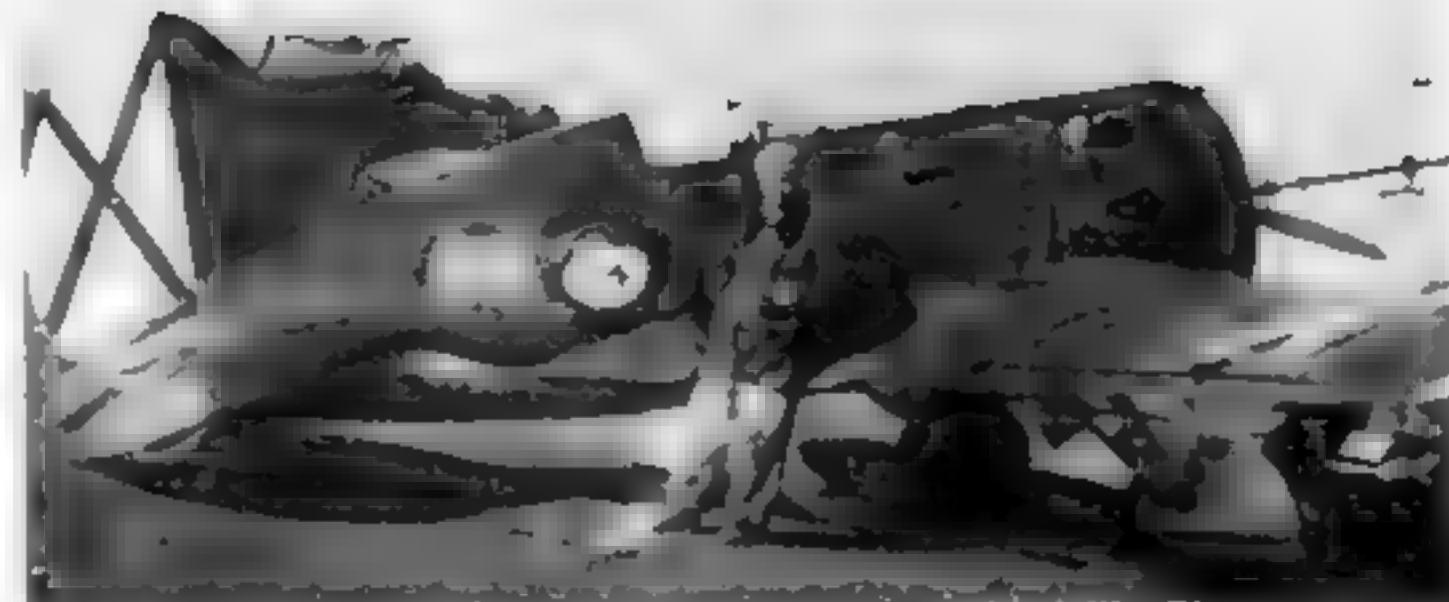
## Spanish I-16 Type 10

During late March of 1938, the first consignment of thirty-one unassembled I-16 Type 10s arrived in Spain after being shipped through France. These I-16 Type 10s were among the first examples of the new fighter built on the GAZ 21 production line. These early I-16 Type 10s were all powered by the M-25A engines. The unit price of each I-16 was fixed at \$40,000 which had to be paid by the Republican Government to the Soviet Union in American currency. Spare parts for the *Moscas* had also to be paid in American currency, an M-25 power plant cost \$6,200 and a single ShKAS 7.62MM gun \$1,000. Juan Negrín, the Republican Finance Minister arranged for the transfer of the Spanish gold reserves to the Soviet Union which were then used to purchase arms in the Soviet Union and by transferring funds via Soviet Banks to Paris, to buy arms in other countries. During the course of the Spanish Civil War, the Soviet Union supplied Spain with various weapons totaling some \$185,000,000.

The *Fuerza Aerea Republicana* (FARE) named the new type received the *Super Mosca*. After assembling of the first I-16 Type 10, the new fighters were immediately assigned to the *la Escuadrilla de Moscas* and the *4a Escuadrilla de Moscas*. With the additional aircraft delivered from the Soviet Union it was also possible to activate the *6a Escuadrilla de Moscas* in July of 1937. This unit was later disbanded in December 1937 due to a lack of available aircraft.

The first combat with the I-16 Type 10 revealed that there were problems in synchronizing the fuselage mounted ShKAS 7.62MM machine guns. As a result, a number of I-16 Type 10s

This I-16 Type 10 carries the insignia of the Fighter School at Moron on the fuselage. The insignia came into use between 1940 and 1941. This was one of the *Super Moscas* captured at the end of the civil war and taken into service with the *Ejercito del Aire* (Spanish Air Force). (Carlo Lucchini)



An Italian volunteer of the Aviazione Legionaria in front of a captured I-16 Type 10. The aircraft in the background is a SM-79 bomber. (Carlo Lucchini)

were modified with the well proven PV-1 7.62MM machine guns which had a lower rate of fire than the ShKAS weapons. These weapons were acquired from I-15 biplane fighters.

A further consignment of sixty-two I-16 Type 10s arrived in Spain on 10 August 1938, aboard the vessel CABO SAN AGUSTIN. These fighters were all standard production I-16 Type 10s with the improved M-25V engine. After assembling, these *Super Moscas* were allocated to the *3a Escuadrilla de Moscas*, *6a Escuadrilla de Moscas* and the *7a Escuadrilla de*

This captured I-16 Type 10 Super Mosca still carries the double dice insignia of the *3a Escuadrilla de Moscas* on the fin. The aircraft was one of a batch delivered to Spain during March of 1938. (Museo del Aire)



*Moscas* By this time a total of some ninety-three I-16 Type 10s had been delivered from the Soviet Union to the *Fuerza Aerea Republicana* (FARE).

In August of 1938, the *4a Escuadrilla de Moscas* commanded by Antonio Arias, was re-equipped with twelve I-16 Type 10s fitted with supercharged Wright-Cyclone SGR-1820-F-54 power plants, smuggled into the country from the United States. These engines allowed the fighters to operate efficiently at heights up to 26,246 feet (8,000 meters). A total of twenty-four Wright SGR-1820-F-54 engines found the way to Spain, but only twelve were fitted to *Super Moscas*, the rest were held in reserve. These aircraft were equipped with oxygen bottles and oxygen masks for the pilot. This oxygen systems were manufactured locally. Test flights revealed that at -40 Degrees Celsius the gun mechanisms of the ShKAS 7.62MM gun froze. J.A. Lopez, the chief engineer of the *4a Escuadrilla de Moscas* overcame this problem by passing filtered exhaust air into the gun boxes. When the unit was disbanded in December of 1938, the Wright-Cyclone equipped I-16 Type 10s were spread among the other remaining Squadrons.

Republicans losses were high in the Summer and Autumn of 1938. During August, eight I-16s were lost in combat and three in accidents. In September, seventeen *Moscas* and *Super Moscas* were reported as missing in action, two were written off after accidents and another I-16 was captured by the Nationalists.

At least one of the captured I-16s was shipped to Germany for evaluation. After reassembly at Rechlin, a flight research program was started 20 September 1938. Most of the evaluation was done by test pilot Heinrich Beuvais of the E2 Department of the Test and Evaluation Center of the Luftwaffe. The E2 Department was engaged in a general evaluation of prototypes and production aircraft for the Luftwaffe and also evaluated captured aircraft. The center was commanded by *Oberstabsingenieur* (Chief Engineer) Harry Bottcher.

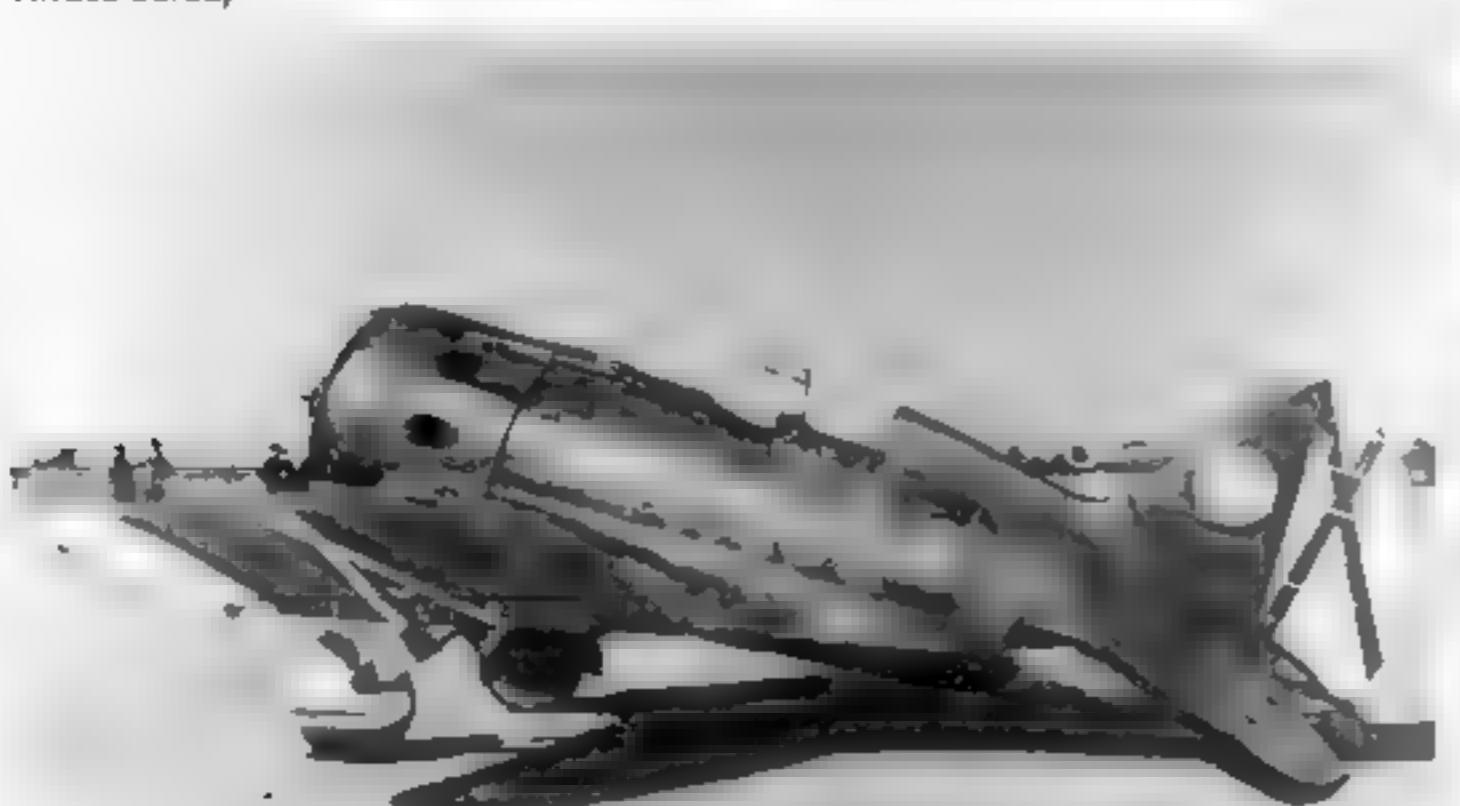
In early November there were only fifty-three airworthy I-16s left in FARE squadrons. By late November 1938, the last Soviet combat pilots returned home. In January of 1939, the serviceable figure was reduced to thirty-four. By early February, no more than twenty were left. On 3 February an order was issued to destroy all unrepairable aircraft. Two days later the

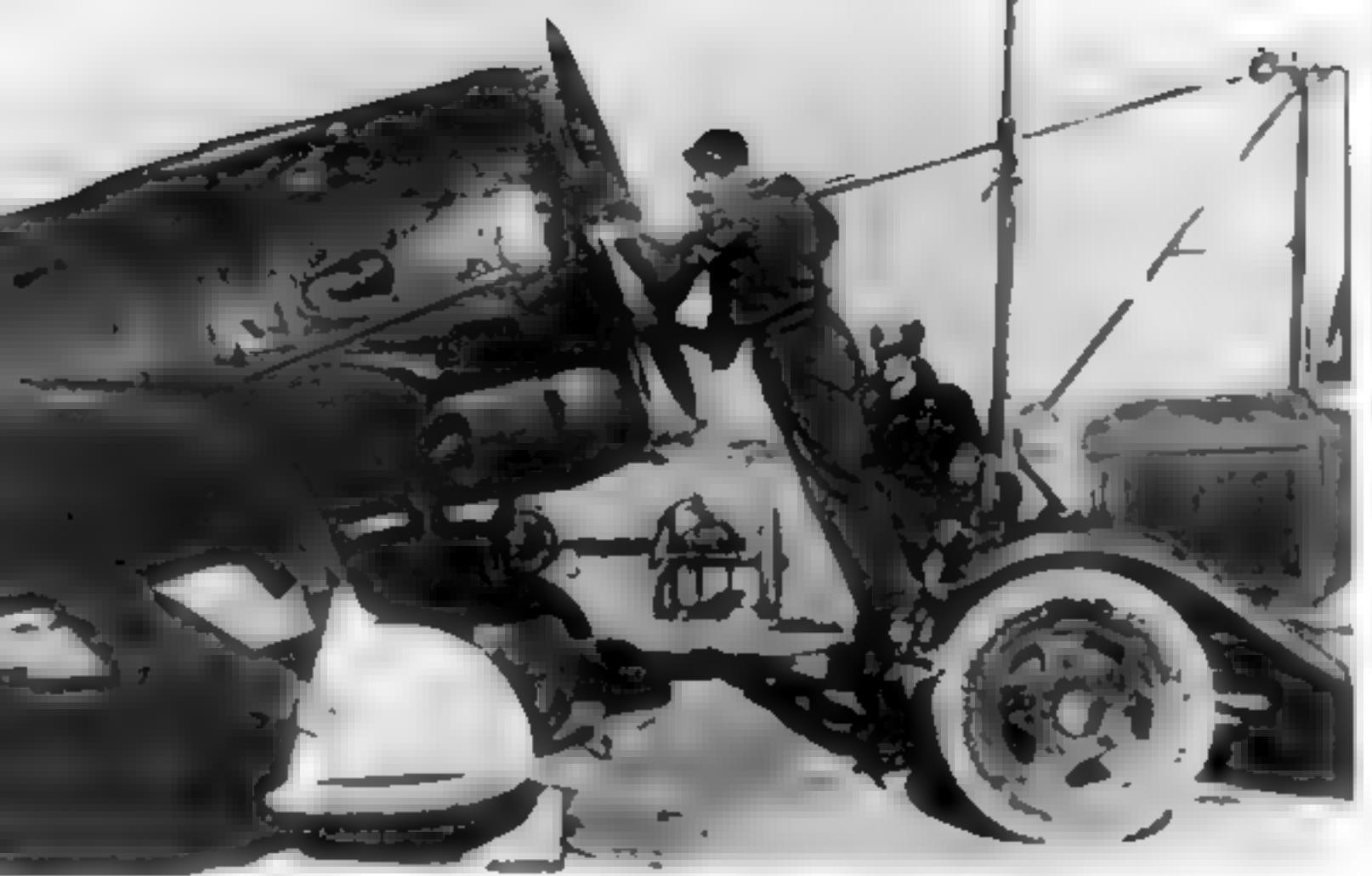
This I-16 Type 10 carried the Yoke and Arrow emblem on the Black fuselage roundel. The aircraft had been flown by the *4a Escuadrilla de Moscas* prior to its capture. (Juan Arreaza Cárdenas)



Captured I-16s were repainted with a Sand and Green camouflage scheme. The wingtips were White with three Black stripes. The aircraft carried the Insignia of Joaquín García Morato's Patrulla Azul (Blue Patrol) on the fin. (Museo del Aire)

Lieutenant (Lieutenant) Bolz of the Legion Kondor poses in front of a captured I-16 Type 10 at Zaragoza Airfield during the Spring of 1939. The T shaped air intake was an identification feature for I-16 Type 10s powered by the M-25V engine. (Harold Thiele)





Ground crewmen prepare to start an I-16 Type 10 using a Hucks starter truck. The wing guns have been removed from this *Mosca*. During operational service, pilots often complained about the lack of a self starter. (Museo del Aire)  
*Mosca* flew its last operational sortie over Catalonia.

Due to the growing air superiority of the Nationalists, reconnaissance missions over enemy territory with the Polikarpov R-5 Rasante and RZ Natacha had become impossible. Only fast fighter aircraft had a any chance of survival. A single I-16 Type 10 was modified by the *Fuerza Aerea Republicana* (FAR) for the reconnaissance role with a camera placed vertically under the pilot's seat. A number of reconnaissance missions were flown during early 1939, by Jacobo Alberdi over Nationalist held harbors of Peniscola and Vinaroz, as well over the La Cerna Air Base, home of the German Legion Kondor.

On 31 March 1939, the Republic surrendered to Franco's Junta. By the time of the surrender no I-16s were operational in the Central Sector, but a number of intact I-16 Type 10s were found at the High Speed Fighter Training Camp at El Carmoli near Cartagena. A further fifteen were rebuilt from parts of various *Moscas* found in the *Servicio de Aviacion y Fabricacion SAE 15* factory at Alicante. In accordance with the Jordana-Berard Agreement, seven I-16 were returned from France to Spain.

## Chinese I-16 Type 10

Following the signing of a mutual assistance pact between the Soviet Union and China in August of 1937, some 200 I-16s of various variants supplied to the Chinese Air Force. Most however, were I-16 Type 10s. The first I-16 Type 10s were delivered to China in the Spring of 1938.

The I-16 Type 10 replaced the Curtiss Hawk II in first-line combat units. The 4th Chinese Fighter Wing became the first unit to operate the I-16 after they had converted from the Hawk.



This I-16 Type 10 was supplied to the Chinese Air Force in standard Soviet camouflage of Olive Green over Light Blue. This aircraft carried the national insignia only on the wing upper and undersurfaces. (Harry Wisch)

I-16 biplane fighter to the I-16 Type 10 at Changkiakow, in northern Shansi.

The I-16 also fought in the largest air battle of the Sino-Japanese War on 29 April 1938, over the Wuhan area. Eighteen Mitsubishi G3M bomber escorted by twenty-seven fighters were intercepted by a force of sixty-seven Soviet-built fighters. Chinese pilots of 3rd and 4th Fighter Groups had nineteen I-152s and six I-16s, the rest being flown by Soviet airmen. During the battle, ten Japanese bombers and eleven fighters were shot down by Polikarpov fighters. The Chinese lost nine aircraft and four pilots while the Soviet lost two fighters and no pilots.

On 31 May 1938, the Japanese launched another raid against Wuhan. The Japanese fleet included eighteen bombers and thirty-five fighters. Thirty-one Soviet and eighteen Chinese fighters were scrambled (thirty three I-152s and sixteen I-16s). During the battle, at least one Chinese I-16 pilot was killed in combat, although the Japanese claimed a total of twenty enemy aircraft destroyed.

In 1939, during the War of Resistance, the Chinese Air Force had a strength of 135 fighters with the I-152 and I-16 forming the backbone of this force. They were opposed by a force of about 900 Japanese aircraft based in occupied China.

Polikarpov fighters were allocated in three groups and three separate squadrons defending Chunking and Chengtu in the center, Lanchow in the north and Kunming in the south.

On 20 February 1939 fifteen Chinese and fourteen Soviet pilots took off in a mixed force of I-152s and I-16s. On this mission they claimed nine enemy aircraft. Twelve bombers were intercepted by Chinese and Soviet Polikarpovs with another six Japanese bombers being claimed on 23 February.

In the Summer of 1939, a number of additional I-16 Type 10s were delivered to China. These saw considerable action during the Japanese strategic bombing campaign which started in October of 1939. In November of that same year Soviet volunteer groups began leaving China. Soviet aid had stiffened Chinese resistance against Japan, but the Soviets themselves

had become "disillusioned and frustrated". They saw their aircraft misused and crashed by inexperienced Chinese pilots who would not follow or had not understood Soviet instructions. They also saw material being hoarded instead of being used in combat.

Chinese pilots faced the formidable Mitsubishi A6M1 Zero for the first time on 13 September 1940, when thirteen pre-production Zeros escorted twenty-seven Mitsubishi G3M2 bombers to Chongkong. Nine I-16 and nineteen I-152s from the 4th Fighter Group scrambled to intercept the bombers, but within minutes they were attacked by Japanese fighters. A total of thirteen Chinese fighters were destroyed and a further eleven damaged. Ten Chinese pilots were killed and eight, including the commander of the 4th Fighter Group, were wounded.

In another engagement, eight Zeros escorted twenty-seven bombers to Chengtu on 4 October 1940 and shot down five of the intercepting I-16s. Nineteen additional I-16s were destroyed on the ground. On 7 October 1940, Kunming was attacked by twenty-seven bombers escorted by seven Zeros, which claimed thirteen I-16s and Curtiss Hawks.

From 19 August 1940 to the end of the year, 153 Zero sorties were flown and their pilots claimed a total of fifty-nine Chinese aircraft, without loss. By June of 1941, the Chinese Air Force had a total of eighty-nine obsolete I-152s and I-16s fighters remaining to fight against ever increasing numbers of Japanese bombers and their Zero escorts.

Chinese fighters seldom got close enough to engage the Japanese long range bombers covered by the Zeroes. On 11 August 1941, seven G4M1 bombers over Chengtu were attacked by I-16s, which were engaged by sixteen Zero escorts, which shot down three I-16s (another two were credited to the bomber gunners). This was the last challenge by Chinese fighter that year. The I-16s was definitely obsolete and the Chinese Air Force ceased to exist as a threat to Japanese air units.

Chinese I-16 Type 10s all carried standard Red Air Force camouflage (Olive Green upper surfaces and Light Blue undersurfaces). Chinese roundels were carried only on the wing undersurface. Blue-White stripes were carried on the rudder and a small White Chinese serial number was painted on the fin.

Hispano Sulza manufactured Super Moscas differed from the original Soviet I-16 Type 10 in having the PAK-1 gunsight replaced by the earlier OP-1 gunsight, which was standard on the I-16 Type 5 and I-16 Type 6. (Museo del Aire)



## Spanish-built I-16 Type 10

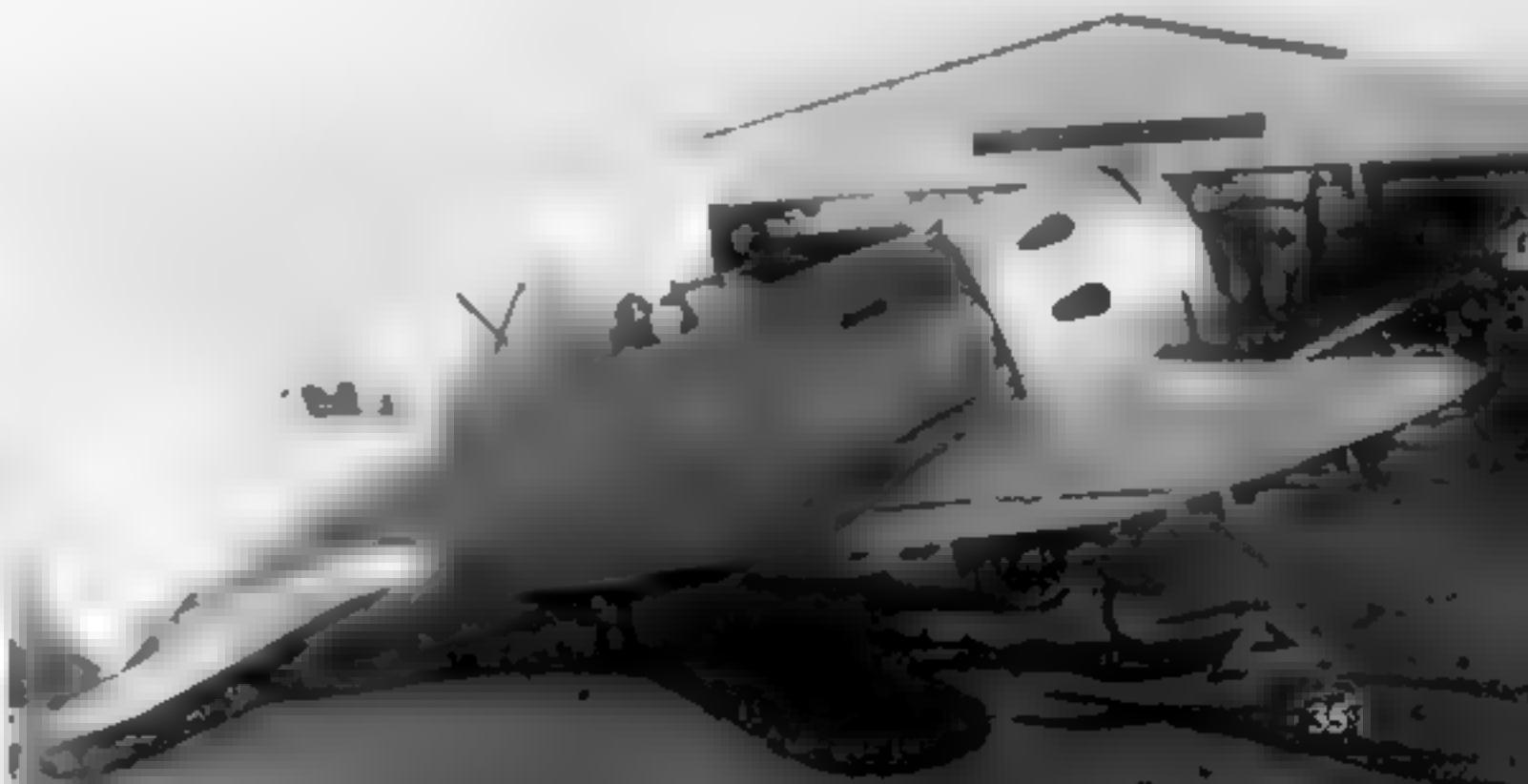
Spanish production of the I-16 Type 10 started during the Summer of 1938 at the *Servicio de Aviación y Fabricación* SAF-15 factory at Alicante. Initially it was planned to built 100 I-16 Type 10 under license, but this figure was never achieved. The Spanish experienced great difficulty in the heat treatment of the center sector wing spars, which were made in Alicante but had to be sent by ship through the Nationalist blockade to Barcelona, where the only suitable furnace was located. Then the parts were returned to the Hispano-Suiza plant at Alcalá de Henares.

Spanish-built *Super Moscas* were, in fact, based on early I-16 Type 10s and were equipped with the M-25A engine. While all Soviet-built I-16 Type 10 were equipped with the PAK-1 gunsight, the Hispano-Suiza manufactured *Super Moscas* were all fitted with the earlier OP-1 gunsight, which was standard on the I-16 Type 5 and the early I-16 Type 6. Also a direct copy from the early I-16 Type 5 and I-16 Type 6 was the use of wide chord flaps. Soviet-built I-16 Type 10s were all equipped with smaller flaps.

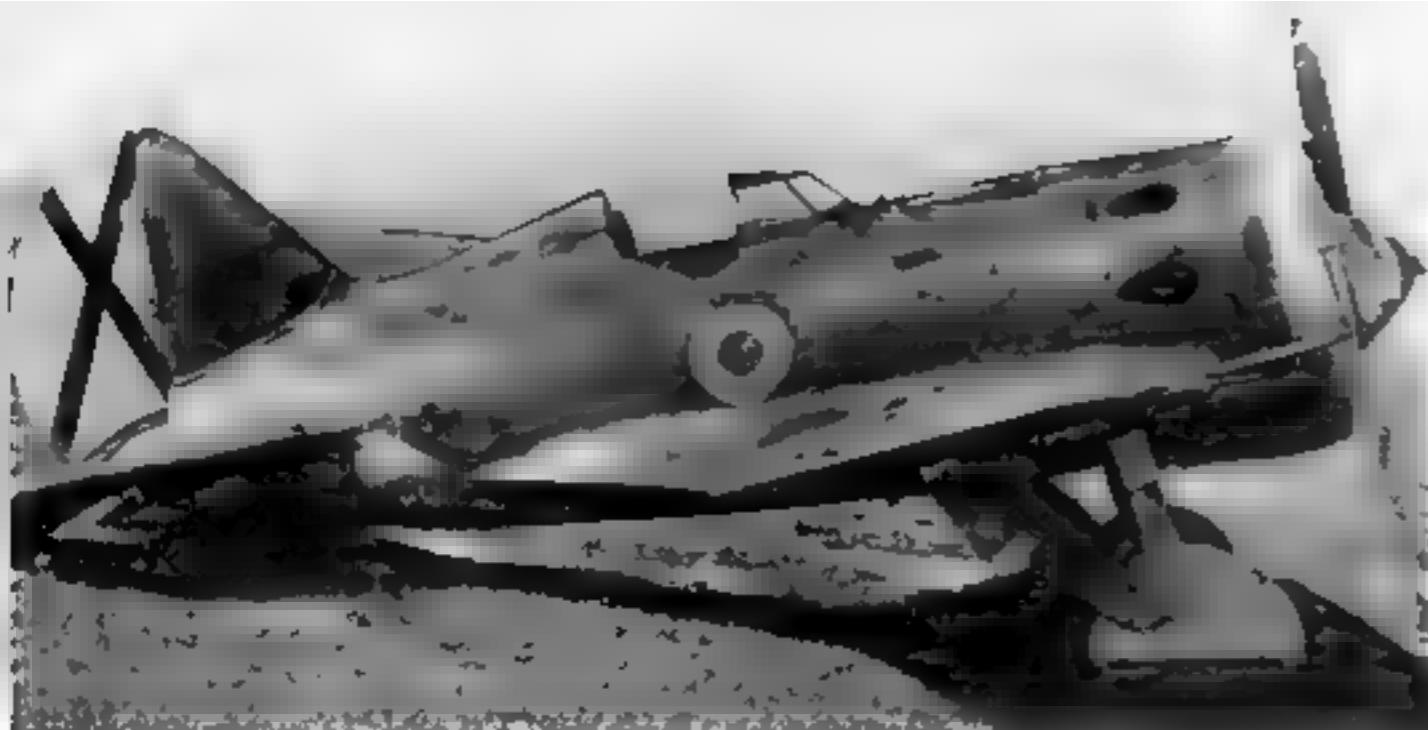
The first four Spanish-built *Super Moscas* were delivered to the *1a Escuadrilla de Moscas* and the *6a Escuadrilla de Moscas* in October of 1938. Ten more were completed by 10 February 1939, when the loss of Catalonia brought production at the Hispano-Suiza plant to a halt.

Thirty-five *Super Mosca* airframes were found in various stages of assembly by the Nationalists. These were transferred to the *Talleres Experimentales Del Aire*, which occupied the buildings in the converted Gonzalez Byass sherry bodega at Jerez de la Frontera for final assembly. The assembled *Super Moscas* were all transported to nearby La Perra Airfield for flight testing and acceptance. The first Jerez-built *Super Moscas* were completed during 1941 and delivered to the *Ejercito del Aire* (Spanish Air Force).

The first Jerez manufactured *Super Mosca* on the ramp at La Perra Air Base shortly before its first flight. The Spanish-built I-16 Type 10 adopted the long chord flaps used on the earlier I-16 Type 5 and I-16 Type 6 as standard. (Museo del Aire)



## Spanish Modifications



C 8-25 was the last airworthy I-16 Type 10 Super Mosca in the Spanish Air Force during 1953. The aircraft featured a flat paneled windscreen and raised dorsal spine. (Museo del Aire)

A number of modifications were incorporated into the I-16 Type 10s assembled at Jerez de la Frontera. They included improvements to the undercarriage retraction system; provision for a steel-tube turnover pylon attached to the pilot's seat. Other improvements were made to the M-25V engine bearer attachment points to reduce vibration and still other changes were made to the control system.

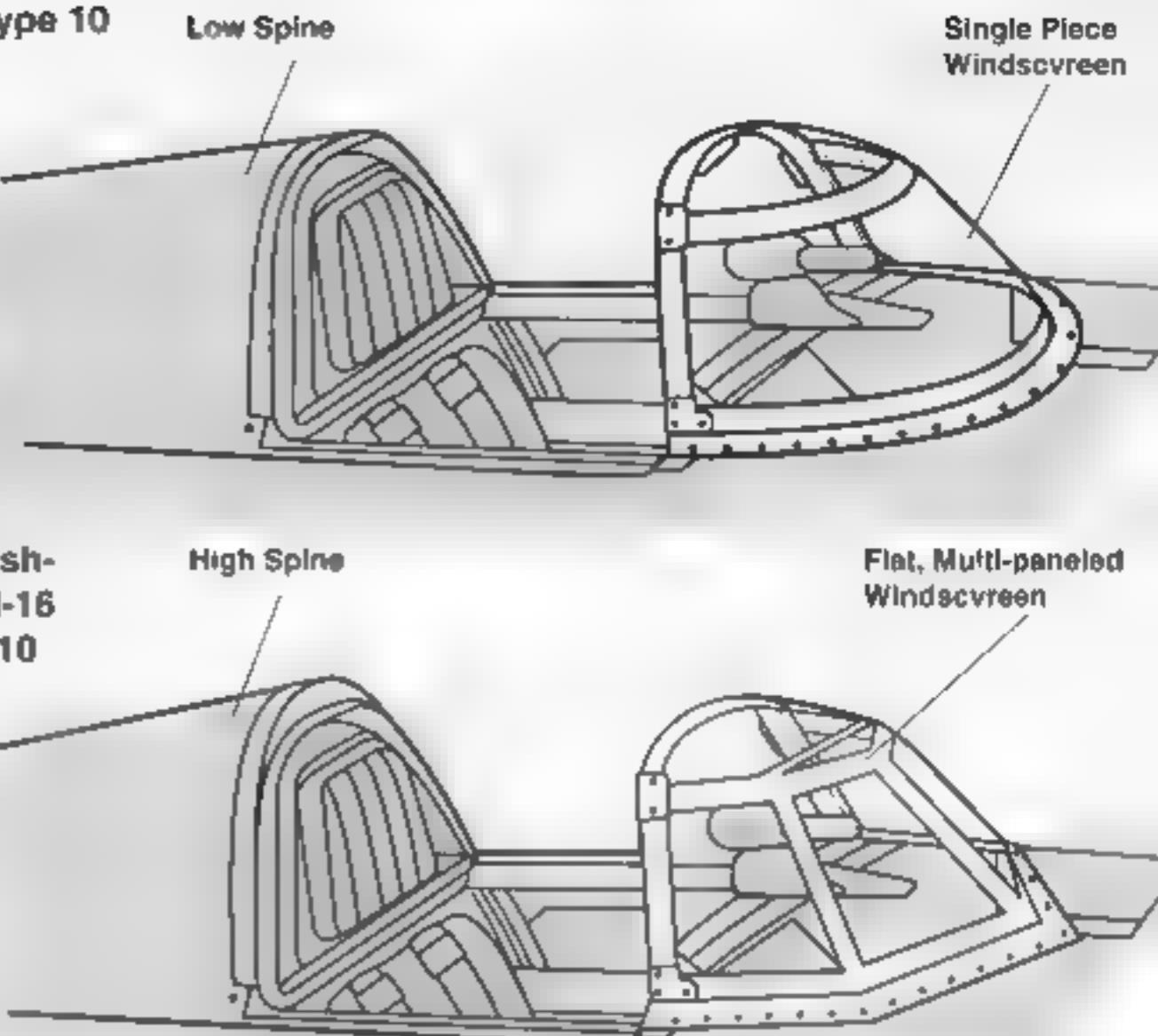
All *Super Moscas* were allocated to the *Grupo 26* of the *Ejercito del Aire*. These were coded JW plus a two digit tail code aircraft letter. They were all based at San Juan Airfield at Maó orca. By this time the Soviet fighter was generally referred to as the *Rata* (Rat). Due to a shortage of modern fighters, the I-16 Type 10 remained in front line duty with the Spanish *Ejercito del Aire* long after it was obsolete. Later *Grupo 26* became part of a newly formed a mixed unit equipped with I-16s and Fiat CR 32s, the *Regimiento Mixto de Caza 22* (22nd Mixed Fighter Aviation Regiment) which was based at Tablada.

For a number of years, a handful of *Ratas* was kept airworthy by cannibalization and improvisation, since no spare parts were available from the Soviet Union. The fuel pump, for instance, came from a Junkers Ju 52/3m. Additionally, the original single piece pitot tube was replaced by a two piece pitot tube.

When the remaining fighters were transferred to the *Escuela de Caza* (Fighter School) at Moron in Seville, the canopy was replaced by a flat-paneled windscreen made of shatter-proof glass. This was necessary because of the poor quality of construction on the original canopies and extended use of the aircraft on sandy the airfields in Spain. The gunsight was removed although the armament of four ShKAS 7.62MM guns was retained. The fuselage dorsal spine behind the pilot seat was raised and some *Ratas* were equipped with a trim tab on the vertical and horizontal stabilizers.

In 1948 the codes used on Spanish I-16s was changed from W to C X. By that time only two original Soviet-built I-16 Type 10s remained in active service, they were marked C X 12 and C X 16. In the early 1950s, most of the I-16s were retired and scrapped. The last airworthy *Rata* (C 8-25) was struck off charge in September of 1953 after serving with the *Escuela de Caza* (Fighter School) at Moron in Seville. *Capitano* (Captain) Ramon Gutierrez Martinez

### I-16 Type 10



and *Capitano* Felipe Sequeros Bores were the last pilots who were licensed to fly the I-16. Almost exactly twenty years after the first TskB-2 prototype took off for its maiden flight from Zhukovsky airfield on 31 December 1933, the operational service of the I-16 came to an end. Franco's *Ejercito del Aire* had become by far the longest operator of the World's first monoplane retractable landing gear fighter.

**Post-war Spanish Super Moscas carried a Sand and Green camouflage with the Spanish roundel on the fuselage, and four wing positions. The Cross of Saint Andrew was painted in Black on the White rudder. (Museo del Aire)**



# I-16 Type 17

The I-16 Type 17 was a variant of the I-16 Type 10 modified for the ground support role. Combat experience in the Spanish Civil War had clearly shown that the standard armament of four ShKAS 7.62MM guns was rather ineffective against ground targets, especially armored vehicles. It was generally acknowledged that large caliber cannons would be needed in order to successfully engage motorized divisions.

A good example of insufficient fire power of Soviet fighters took place during battle of Guadalajara in March of 1937, when the Nationalists attacked the Jarama river in an attempt to encircle the capital of Madrid. The ineffective strafing attacks flown by I-16s against the Italian motorized divisions brought home the lesson for the Soviet advisors that large caliber weapons were needed on the battlefield. At this time the Soviet Union lacked of a ground attack fighter in their own inventory.

The idea of arming the I-16 with large caliber guns was not an entirely new project. Earlier the Polikarpov Design Bureau had gathered a good deal of experience with their cannon armed I-16P and TsKB-12P projects. On both these prototypes the 20mm ShVAK cannons had been installed in the wings. Both of these prototype installations of the ShVAK, however, were never developed beyond the testing stage.

The I-16 Type 17 had the two wing mounted ShKAS 7.62MM guns replaced by the two ShVAK 20MM cannons, while the fuselage synchronized 7.62MM machine guns were retained. The ammunition supply for the two ShVAK cannons was 150 rounds per weapon, consisting of either armor piercing or explosive rounds, or a mixture of both.

I-16 Type 17s can be easily identified from the earlier I-16 Type 10 by the long barrels of the 20mm ShVAK cannon. Part of the gas pressure cylinder was also visible under the barrel. The 20mm cannon became available during 1936 and had a rate of fire of 750 to 800 rounds per minute.

A number of internal changes were also introduced on the I-16 Type 17, due to its increased gross weight. The I-16 Type 17 had a gross weight of 3,991 pounds (1,810 kg), while the earlier Type 10 had a gross weight of 3,805 pounds (1,726 kg). Even with the additional weight

A ski equipped pre-production I-16 Type 17 undergoes armament testing as part of the State Acceptance Trials. The long barrel of the 20mm cannon is visible just above the landing gear. (A. A. Zirnov)

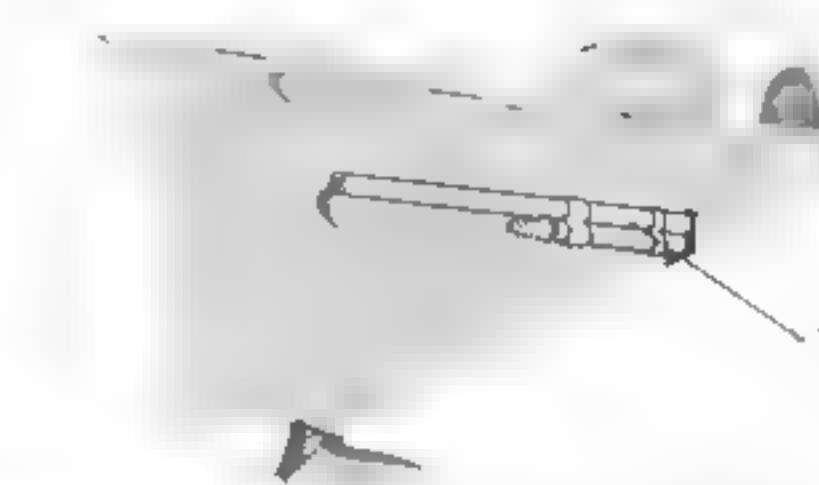
## Wing Armament

### I-16 Type 10



7.62MM ShKAS  
Machine Gun

### I-16 Type 17



20MM ShVAK  
Cannon

An I-16 Type 17 of the 4th Guards Regiment, Baltic Fleet taxies out on Vystav Airfield for another mission during the Spring of 1942. The hinged portion of the main landing gear wheel doors has been removed. While most I-16 Type 17s had their propeller spinners deleted, this aircraft retains its spinner. (G. F. Petrov)





An I-16 Type 17, White 43, taxis out for another mission in the Leningrad area in the Summer of 1941. Shortly after the start of the war, large White tactical numbers began to be used on the fuselages sides. (Yefim Gordon)

Senior Lieutenant G. S. Zhukov of the 191st Fighter Aviation Regiment poses with his rather weathered I-16 Type 17. The aircraft has no propeller spinner and the hinged doors of the landing gear have also been removed. (Zdenek Hurní)



An I-16 Type 17 on final approach for landing. The main difference between the Type 10 and Type 17 was the change in armament from wing mounted 7.62mm machine guns to 20mm cannon. (Ivan Ivanov)

of two cannons, the top speed of the I-16 Type 17 was only slightly reduced. The Type 17 had a top speed of 264 mph (425 km/h) compared to 278 mph (448 km/h) for the Type 10. The rate of climb, however, was greatly reduced. The Type 17 had a rate of climb of 1,843 feet per minute, while the Type 10 had a rate of climb of 2,430 feet per minute.

Most I-16 Type 17s were assigned to ground attack duties and had the propeller spinner deleted, although this was not a standard feature.

The first I-16 Type 17 left the assembly lines at GAZ-21 and GAZ-153 during 1938. Due to the fact that only a limited number of the new ShVAK 20mm cannons were available for the I-16 Type 17 and later I-16 Type 27, only 1,184 aircraft of both versions of the cannon armed fighter were built through the Spring of 1940.

When the first I-16 Type 17s reached Red Air Force regiments during late 1938, they were rushed into combat against the Japanese during the Nomonhan Incident. This undeclared war which began on 11 May 1939, along the ill-defined Manchurian-Mongolian border lasted four months.

I-16 Type 17s were never exported, and when the Germans invaded Russia on 22 June 1941, the I-16 Type 17s performed well in the ground support role against advancing troop concentrations and armored vehicles. The I-16 Type 17 saw action on the main battle fronts, until the Il-2 became available in quantity. After that, it was deployed to minor theaters of operations, such as the Baltic and the Black Sea district.

# I-16 Type 18

The I-16 Type 18, was a direct result of a request from the front line units for a more powerful engine. As a result of the research work carried out by Arkady D. Shvetsov and his team at the GAZ 19 aero-engine factory at Perm, a new, more powerful engine, the Shvetsov M-62 was ready for operational testing in 1937. The main difference was that the M-62 offered better high altitude performance than the M-25.

The M-62 was basically a Soviet copy of the American Wright Cyclone R-1820-G-5 air cooled, radial engine. While the cubic inch capacity of the engine remained unchanged from the M-25V, the M-62 had a two speed supercharger in place of the single speed supercharger used with the M-25V. As a result, the M-62 now had a rating of 1,000 hp compared with 775 hp for the M-25V. While the M-25V used 87 octane fuel, the M-62 had to be serviced with 92 octane fuel. One drawback was that the installation of the M-62 power plant resulted in a considerable increase of weight, with the engine being some 103 pounds (46 kg) heavier than the M-25V.

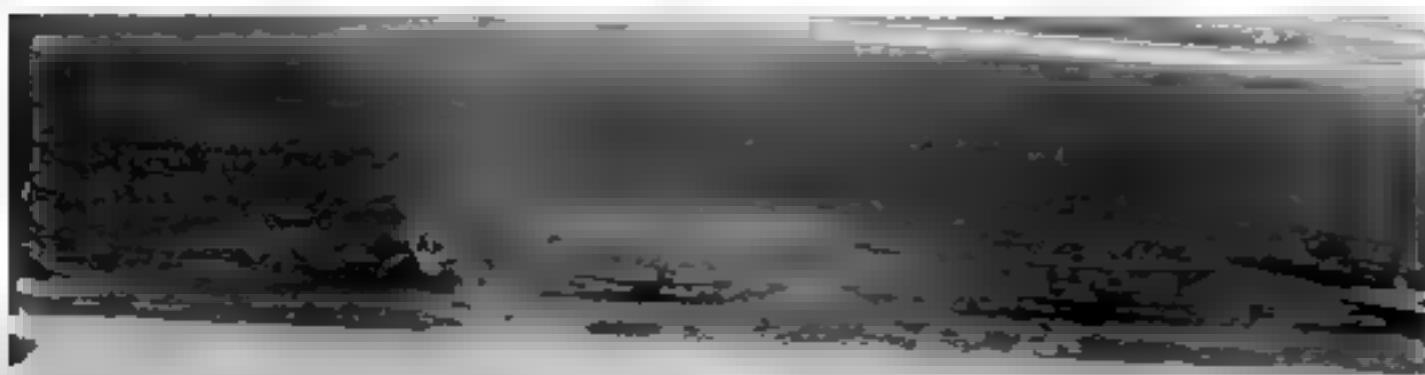
During early 1939, an M-62 was installed in a I-16 Type 18 and factory trials with the new engine began at Zhukovsky. The M-62 powered I-16 Type 18 differed from the I-16 Type 10 in having an additional cooling air intake on top of the engine cowling. In addition, there were two exhaust stacks in the lower exhaust port position in place of the single stub on the I-

Type 10.

M-62 powered aircraft also were fitted the a variable-pitch AV-1 propeller. Externally the AV-1 propeller could distinguished from the earlier propellers by the two round balance weights on the propeller hub and the wide chord propeller blades. The propeller spinner was also enlarged to accommodate the AV-1 propeller.

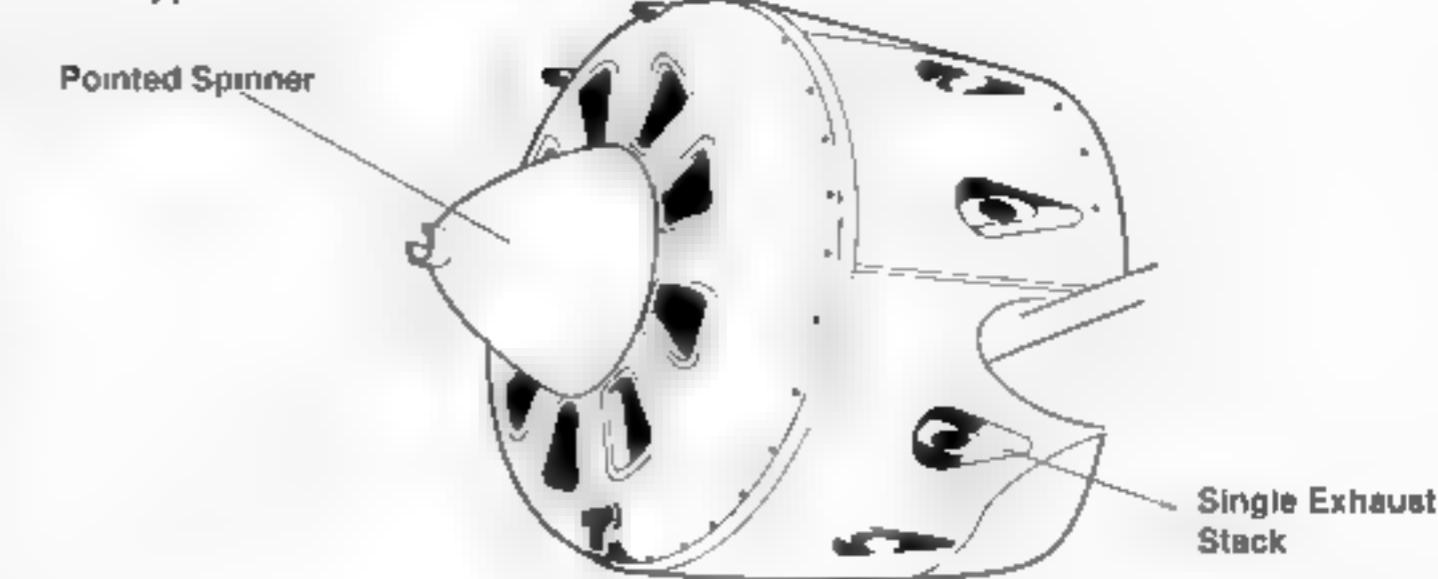
Thanks to the more powerful M-62 engine and variable pitch propeller, the I-16 Type 18 had a considerable increase in performance especially at high altitudes. While the I-16 Type 10 had a top speed of 278 mph at 10,367 feet (448 km/h at 3,160 meter) the I-16 Type 18 had a speed of 288 mph at 14,235 feet (464 km/h at 4,400 meter). In addition, the service ceiling was raised from 27,099 feet (8,260 meter) to 31,069 feet (9,470 meter).

A line-up of various I-16 and I-153 experimental fighters at Zhukovsky on 14 June 1940. The I-16 Type 18 (last aircraft in line) has a large White 1E on the fin. (Robert Bock)

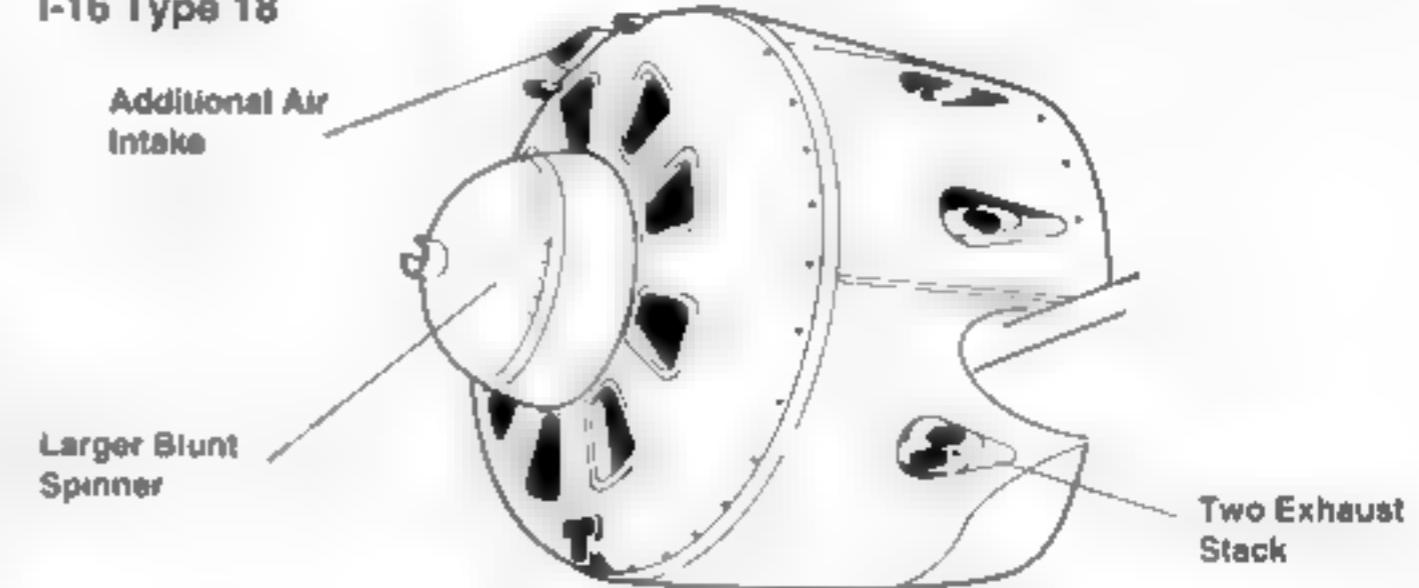


## Cowling Development

### I-16 Type 10/17



### I-16 Type 18



Apart from the new engine and the AV-1 propeller the first production batches of the I-16 Type 18 were very similar to the I-16 Type 10. As a result the only visual identification feature to tell a standard I-16 Type 10 from the I-16 Type 18 were the enlarged spinner and the upper air intake on the engine cowling.

Later production variants of the I-16 Type 18 had an additional cockpit entry door added to the starboard side of the fuselage. Early I-16 Type 18s had a tailskid adopted from the I-16 Type 10, while later I-16 Type 18s were equipped with a tailwheel.

The armament of the I-16 Type 18 was the same as the I-16 Type 10. Due to the greater fuel consumption of the M-62, range dropped from 326 miles (525 km) to 301 miles (485 km). As a result the I-16 Type 18 was modified with provision to carry two 52.8 gallon (200 liter) slipper type auxiliary fuel tanks under the wings which increased the maximum attainable range to 1,683 miles (1,100 km).

The I-16 Type 18 was only regarded as an interim variant, intended to keep production going until the more advanced M-63 power plant became available for the I-16. As a result, a limited number of the I-16 Type 18s were actually built.

The I-16 Type 18 received its baptism of fire in the final stages of the Nomonhan Incident over Mongolia when it saw action against the Japanese. The I-16 Type 18 also took part in the Winter War against Finland and in the Great Patriotic War.

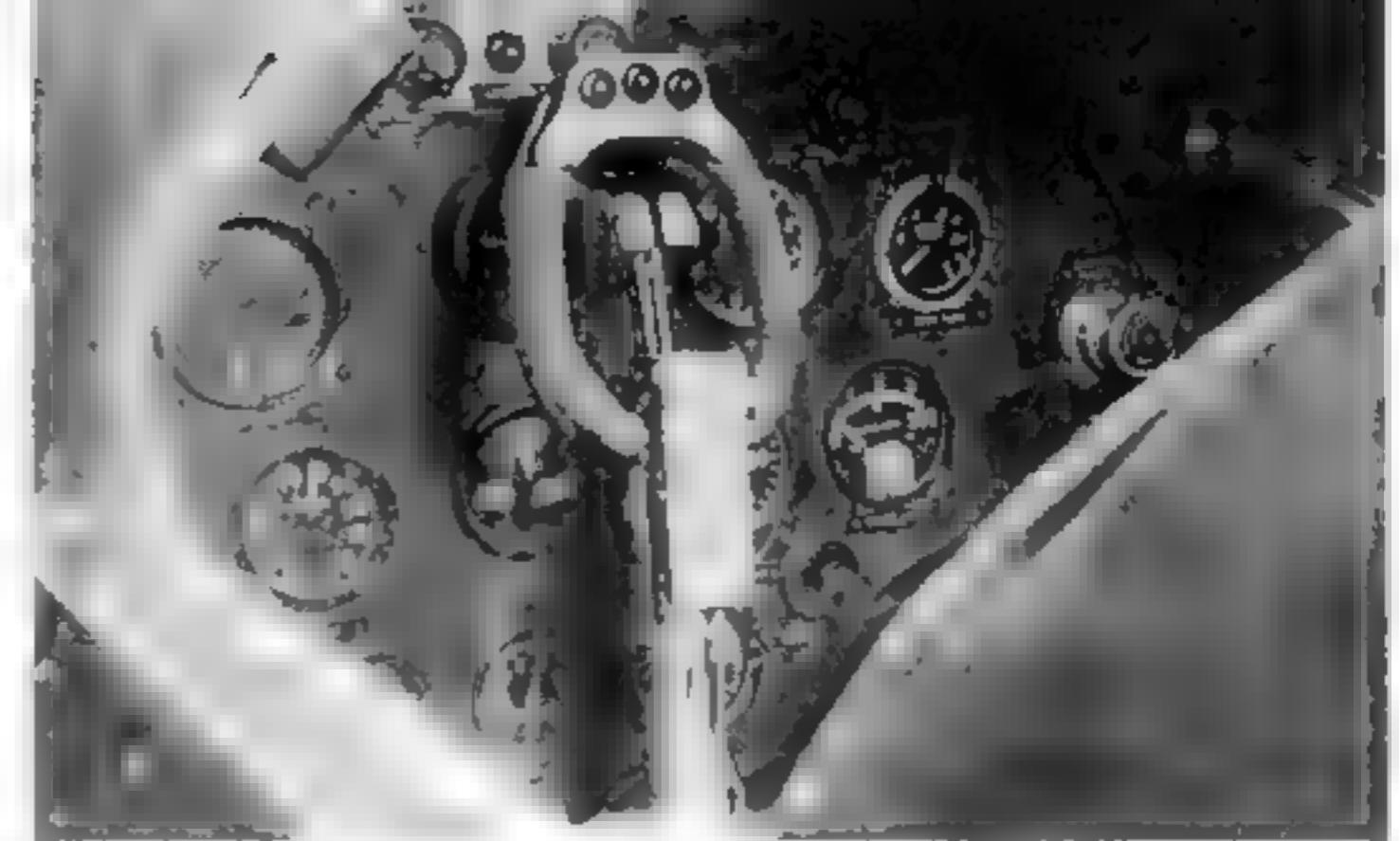
## Finnish I-16 Type 18

During the Winter war with Finland (November 1939 to March 1940) a single early production ski-equipped I-16 Type 18 was captured after making a forced landing on Finnish soil.

The aircraft was serialled VH 201. This was later changed to VH-21, when the original Soviet camouflage was replaced with Black Green and Olive Drab Finnish Air Force camouflage. The original Silver AV-1 propeller was painted Black with Yellow tips. On 10 April 1940, the aircraft suffered an engine failure and crash-landed on frozen Lake Pyhajarvi, however, the pilot, Lieutenant J. Visapaa, escaped uninjured. After repairs, the aircraft was allocated to *Lentolaivue 24* on 12 March 1941. On 15 April of that same year VH-21 was transferred to Germany, the first a late production I-16 to become available for testing. The Finnish Air Force had logged only six hours twenty minutes during its evaluation of the aircraft.

(Right) An I-16 Type 18 and Messerschmitt Bf-109F-2 share an airfield in Russia during the early days of Operation BARBAROSSA. The Messerschmitt was assigned to IV.JG 54. (Heinz J. Nowarra)

An early production I-16 Type 18 during final assembly. The early production variants of the Type 18 were fitted with a tailskid, while later aircraft were fitted with a tailwheel. This aircraft has the Red star national markings on the fin and fuselage and has a large White six inside the fin star. (Ivan Ivanov)



The control stick and Instrument panel of an I-16 Type 18. The triggers for the four 7.62mm machine guns is in the center of the control wheel. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)



Sailors prepare an I-16 Type 18 of the Black Sea Fleet for another mission. The front half of the spinner was painted in Yellow. This was an early production Type 18, equipped with a tail skid. (Ivan Ivanov)





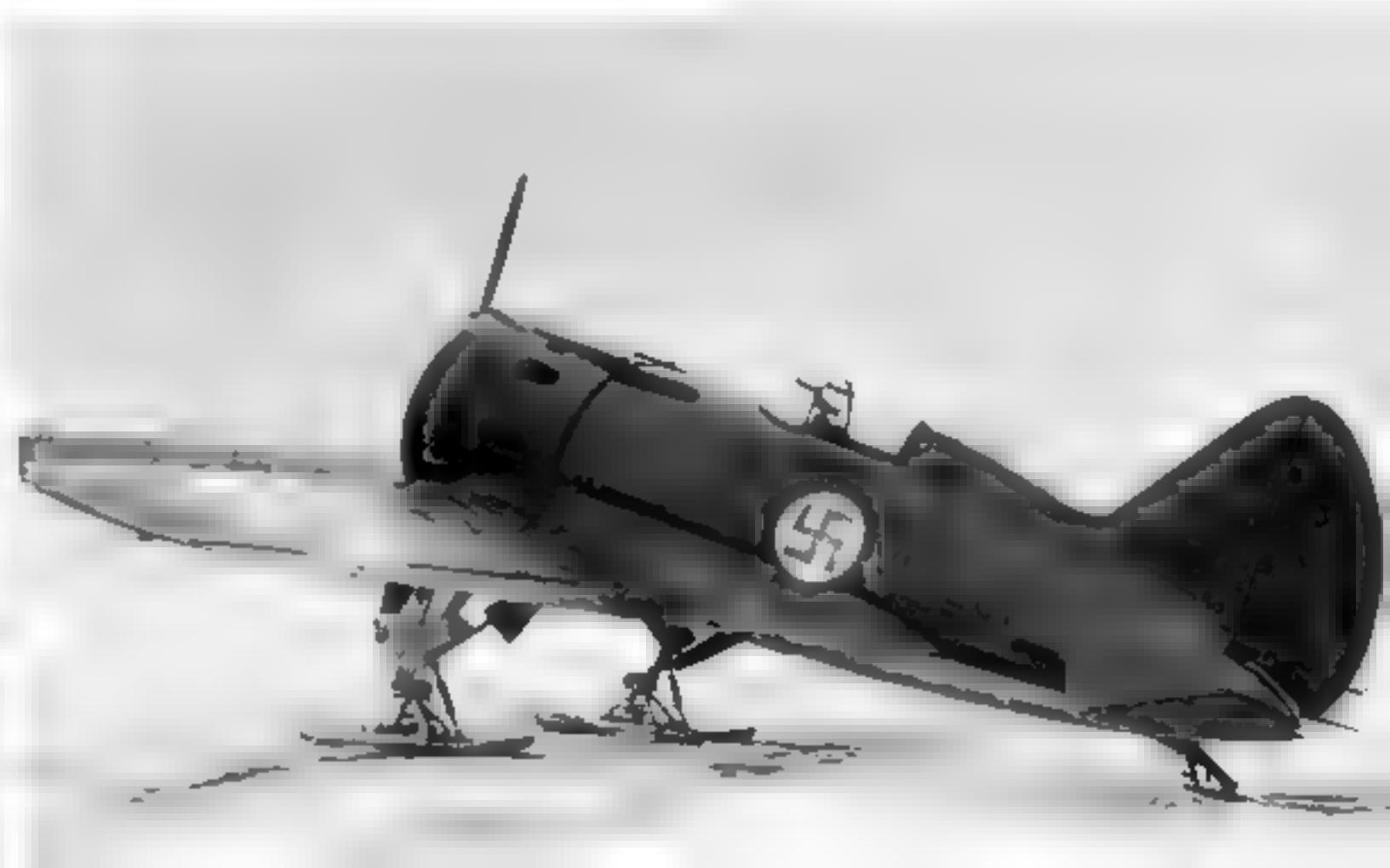
The I-16 Type 18 was the first variant to be equipped with a retractable ski landing gear. The cables that retract the landing gear through the pilot's hand crank are visible attached to each ski. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)

As the skis retracted they pivoted to lay flat along the fuselage underside. The twin exhaust stacks in the lower exhaust port were an identification feature of the I-16 Type 18. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)



Fully retracted, the skis fit into cut-outs in the fuselage underside. In addition to the retractable skis, the I-16 Type 18 was the first variant to have provision for 52.8 gallon (200 liter) underwing slipper type fuel tanks. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)

This Type 18 was captured by the Finns after it crash landed in Finland during the Winter War. It was coded VH-201 and was later repainted in Finnish camouflage and markings. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)



# I-16 Type 24

Shortly after the I-16 Type 18 production was firmly established at GAZ-21 and GAZ-153 the Poiskarpov OKB developed a new, even more powerful version. This development was possible because of continued engine improvements being made at GAZ-19, the aero-engine factory at Perm. They had continued work on the M-62 and could now offer an uprated version, the Shvetsov M-63 for installation into the I-16.

The M-63 was rated at 1,100 hp for take off with only a twenty pound increase in weight over the 1,000 hp M-62. This engine was selected for installation into the I-16, resulting in the I-16 Type 24.

The I-16 Type 24 introduced a number of structural improvements to the fuselage and wings. The thickness of the wing skinning was increased along with additional ribbing. An inspection hatch was installed on the rear starboard fuselage. Apart from this hatch, the I-16 Type 18 and I-16 Type 24 were externally nearly identical.

The State Acceptance Trials of the I-16 Type 24 started during the first half of 1940, and revealed that there was no considerable improvement in flying characteristics in comparison with the I-16 Type 18 and, in fact, maneuverability was slightly inferior. The increased weight due to the structural refinements of the wing and fuselage had offset the additional power offered by the M-63 power plant. The gross weight of the I-16 Type 24 had increased to 4,149 pounds (1,882 kg). The top speed was only slightly higher than on the I-16 Type 18 at 292 mph (470 km/h) at 15,748 feet (4,800 meters). The rate of climb of 2828 feet per minute was slightly less than the I-16 Type 18 (3,154 feet per minute). The only real improvement the M-63 offered was in service ceiling, which increased to 32,480 feet (31,069 for the I-16 Type 24). The increased fuel consumption of the M-63, however, led to a reduced range in range to 273 miles (440 km).

A Sergeant gives last minute instructions to an I-16 Type 24 pilot. The starboard side cockpit entry door was one of the features of the Type 24. (Dr. Volker Koos)



A number of I-16 Type 24s were camouflaged in a two tone uppersurface scheme of Olive Green and Dark Green, like this Type 24, Yellow 30. (G. F. Petrov)

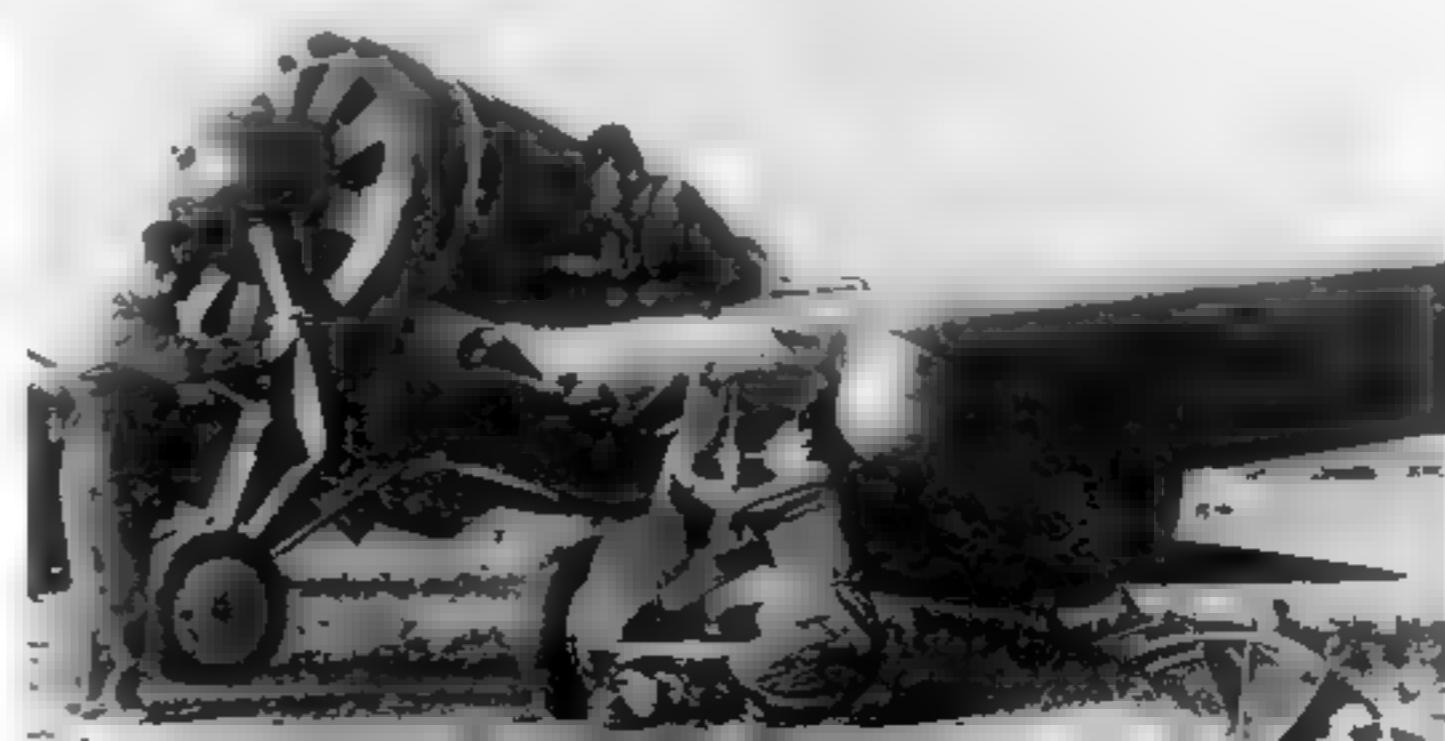
ton in range to 273 miles (440 km)

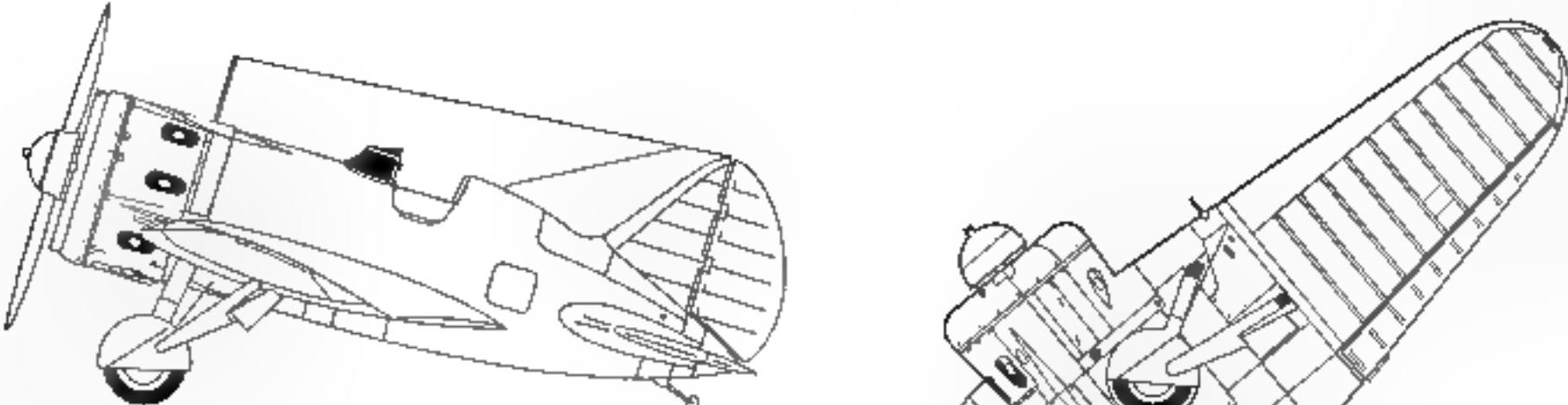
Regardless of its shortcomings, the I-16 Type 24 was ordered into production and it soon replaced the I-16 Type 18 at GAZ-21 and GAZ-153, where it was built in substantial quantities.

On 1 October 1938, the Soviet Air Force had a total of 1,763 I-16s in its inventory, and by 10 February 1939, this total had increased to 2,004. The majority of these fighters were based in the Leningrad, Kiev, Moscow, Belorussian and Transbaikal Military districts and in the Far East of the Soviet Union.



Maintenance personnel perform an overhaul on this I-16 Type 24 in the field during the Summer of 1940. This aircraft is configured with underwing 200 liter slipper type fuel tanks. (G. F. Petrov)

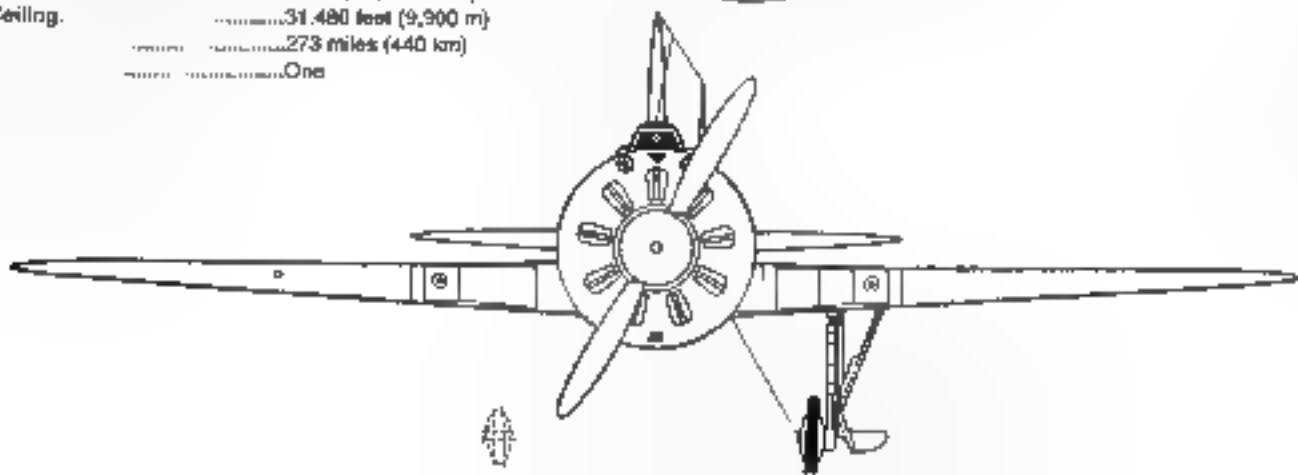
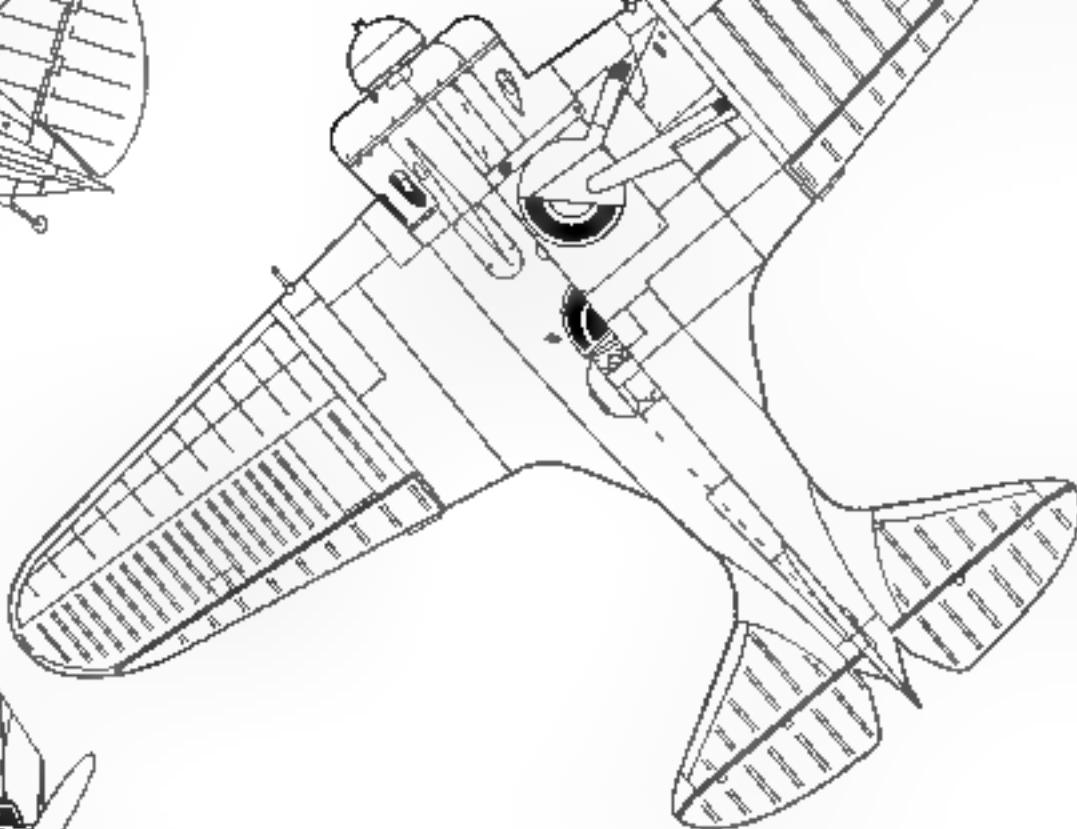




## Specification

### Polikarpov I-16 Type 24

Wingspan.....	28 feet 1 3/4 inches (8.64 m)
Length.....	9 feet 8 1/8 inches (6.02 m)
Height.....	7 feet 9 3/4 inches (2.36 m)
Empty Weight.....	3,252 pounds (1,475 kg)
Maximum Weight.....	4,541 pounds (2,069 kg)
Powerplant.....	One 100 hp Shvetsov M-63 air-cooled radial engine
Armament.....	Four 7.62mm ShKAS machine guns
Speed.....	292 mph (470 km/h)
Service Ceiling.....	31,480 feet (9,900 m)
Range.....	273 miles (440 km)
Crew.....	One



## I-16 Type 27

The I-16 Type 27 replaced the cannon armed I-16 Type 17 on the production lines at GAZ-21 and GAZ-153. The I-16 Type 27 was based on the I-16 Type 18 airframe, with the M-62 power plant but using the armament of the I-16 Type 17.

Due to the greater fuel consumption of the M-62, the I-16 Type 27 had provision for carrying two 52.8 gallon (200 liter) slipper-type auxiliary fuel tanks.

Like the earlier I-16 Type 17, the I-16 Type 27 was armed with two ShVAK 20mm cannons with 150 rounds each in the wing and a pair of synchronized ShKAS 7.62mm guns with a supply of 650 rounds mounted on the upper front fuselage.

The first I-16 Type 27s were delivered during the first half of 1939 and saw combat over Mongolia against the Japanese. Due to the shortage of ShVAK cannons for the I-16, only a limited number of I-16 Type 27s were built.

During the Great Patriotic War I-16 Type 27s saw combat in the assault and ground support roles. Due to the fact that many I-16 assault regiments operated from muddy and unprepared fields, most I-16 Type 27s had the main wheel covers removed.



(Above & Below) An I-16 Type 27 being readied for a ground attack sortie. The aircraft has the main landing gear doors removed for operations on unprepared fields. The Type 27 was the last cannon armed variant to be built. (Yefim Gordon)

## I-16 Type 29

The emphasis behind the development of the I-16 Type 29, was the fact that a new, more effective 12.7mm machine gun had become available and as a result, the Pionkarpov Design Bureau was ordered to install the new Berezin UBS weapon in the I-16 airframe. The new fighter, designated the I-16 Type 29, passed the State Acceptance Trials during 1940 and the type was ordered into production at GAZ-21 and GAZ-153.

The I-16 Type 29 was developed using the I-16 Type 24 airframe and the main difference was the introduction of the new armament. The Berezin UB gun had a rate of fire of 700 to 800 rounds per minute and a muzzle velocity of 2,755 feet per second (840 meter per second). There were two versions of the basic 12.7mm weapon, the Berezin UBS (synchronized) and the Berezin UBK free firing weapon. Generally, there were three different types of ammunition used, the standard ball projectile with a Black-Yellow head, tracers with a Violet-Red head, incendiary projectiles with a Black-Red head.

The mounting of the new Berezin UBS gun in the lower nose under the cowling made it necessary to relocate the lower air intake scoop to the starboard side of the lower nose. While the air intake scoop on the I-16 Type 24 was 'T' shaped, the I-16 Type 29, had an enlarged squared off air intake to the starboard side.

A number of I-16 Type 29s were equipped on the production line with the RSI-3 radio. Aircraft with this installation could be identified by an antenna mast on the upper starboard side of the engine cowling in front of the canopy.

Most I-16 Type 29s were used in the ground support role and the aircraft had provision for six R-8-82 rocket rails, three under each wing. These rails were used to fire RS-82 air-to-ground unguided rockets. While the standard rocket fit was six rails, a number of I-16 Type 29s were outfitted with four rails.

A number of I-16 Type 29s were also fitted with a bomb rack inboard of the rocket rails. This bomb rack could carry bombs up to 220 pounds (100 kg). Bomb types included the general purpose FAB-50 or FAB-100 bombs, the AO-10, AO-20M or FAB-50M fragmentation bombs or ZAB-50TG incendiary bombs. These bombs were generally painted Gray, with a variety of different color codes on nose to denote purpose. Anti-armor bombs had Yellow-Red stripes, while fragmentation bombs were had Green and Blue stripes. The I-16 could also

A pre-production I-16 Type 29 during the aircraft's State Acceptance Trials. The aircraft carries underwing slipper fuel tanks, rocket rails and a radio antenna mast. (A. A. Zirnov)





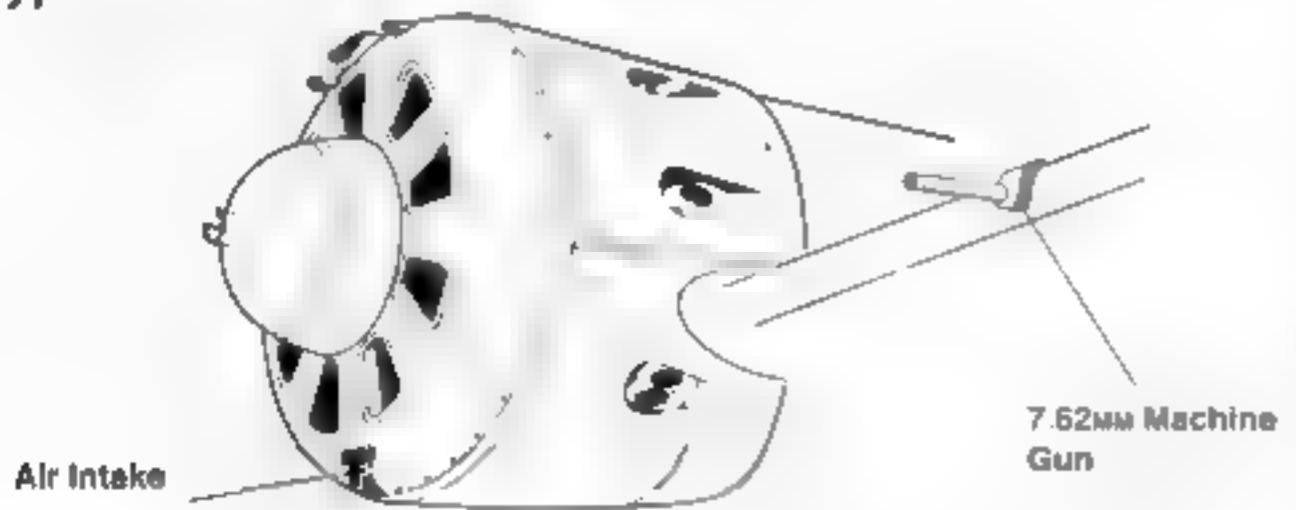
This I-16 Type 29, White 75, of the 71st Fighter Aviation Regiment was painted in a two tone uppersurface camouflage. The aircraft was armed with two RS-82 rockets under each wing. (G F Petrov)



An I-16 Type 29 taxies out from its wooden shelter for a mission during the Autumn of 1941. The aircraft was configured with two bomb racks just outboard of the landing gear (G. F Petrov)

### Cowling Development

#### I-16 Type 24

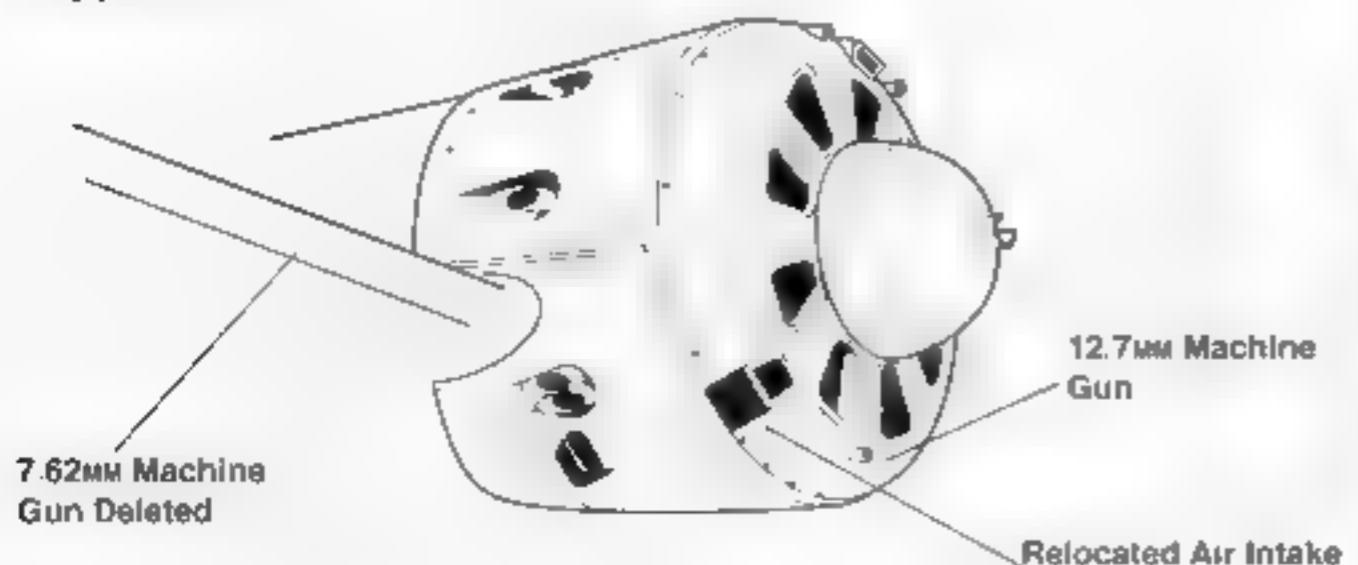


carry bombs containing chemical agents, such as the ChAB-25, the AOCh-15. The chemical agent was loaded into ordinary fragmentation bombs shortly before a mission. Bombs containing chemical agents were marked with a Yellow Blue band. There were two major types of chemical agents used against the advancing Wehrmacht, mustard gas and phosgene gas.

A fully loaded I-16 Type 29 with underwing tanks and armament had a top speed of 237

Luftwaffe personnel inspect a jacked-up I-16 Type 29, White 2. This aircraft was configured with a camera under the starboard wingtip, which caused the Red star to be off set further out on the underside of the wing. (Manfred Griehl)

#### I-16 Type 29



mph (382 km/h) at sea level and 266 mph (429 km/h) at altitude. Compared to the contemporary Messerschmitt Bf-109F-1, the I-16 Type 29 was totally inferior in all aspects, except maneuverability in close turn combats.

The development of the I-16 was determined mainly by the appearance of new engines. In the process of development of the I-16 from the initial Type 5 to the ultimate Type 29, top speed was slightly improved, while the rate of climb became better due to the M-62 and M-63 engines and variable pitch AV-1 propeller. This was offset by a loss in horizontal maneuverability, which gradually got worse because of the weight increases. The main reason that top speed never increased dramatically was that the various engines offered only relatively small increases in power. Throughout its production life, the I-16 power was increased by some twelve percent, while the power of the German Messerschmitt Bf-109 had increased by sixty seven percent. Though the M-62 and M-63 engines were of the best in the family of single row radial air cooled engines, there was no further prospect of increasing their power.

## Romanian I-16 Type 29

Shortly after start of the Second World War (Great Patriotic War) a Soviet pilot detected with his I-16 Type 29 to Romania, and landed in a field near the town of Dorohoi in Moldavia on 8 July 1941.

This aircraft was captured by the *Fotele Aeriene Regale Ale Romaniei* (Royal Romanian Air Force) and an order was issued to the ground crews of the *Escadrila 19 Observatie* (19th Reconnaissance Squadron) based at Botosani to dismantle the fighter at Dorohoi and to transport the I-16 Type 29 to Botosani.

A line-up of I-16s of the Baltic Fleet during the Autumn of 1943 near Leningrad. White 12 is a Type 29 with the propeller spinner removed. The next aircraft in line, White 96, is a Type 27. The third I-16 in the line had the national insignia on the fuselage and rudder, while the first two carry the star on the fuselage alone. (Ivan Ivanov)

When the aircraft was being reassembled it was found that the starboard rear fairing for the fuselage mounted machine gun was missing. As a result the subsequent flight tests were flown without the fairing. The I-16 Type 29 was repainted with a large Yellow identification band and Yellow wing tips, the type carried on all Axis aircraft on the Eastern front. Initially only a Blue-Yellow-Red fin flash was carried, but later the aircraft carried full national markings and the number White 1 on the tail. The tactical number, White 1, was reserved as a serial number for the captured aircraft. Later, a captured MiG-3 fighter received the number White 2 also painted on the tail.

After re-assembling the I-16 at Botosani, the aircraft was assigned to Captain Ciocean Popescu for the first flight. After the landing Captain Popescu praised the extraordinary maneuverability of the I-16.

For the men of the 19th Reconnaissance Squadron the I-16 was of particular interest, since they had had a number of encounters between Soviet I-16s and their IAR-39s. Since it was fairly certain that there would be more in the future, Captain Popescu planned to use the captured I-16 in mock combat training against IAR-39 crews. As result, a radio was installed in the I-16 and several IAR-39 crews were trained in possible countermeasures for use against the Soviet fighter during the Summer 1941. This training proved to be very effective. Between 22 June and 13 July 1941, three I-16s shot down by IAR-39 crews for a loss of two IAR-39s.

In early September of 1941, the Romanian High Command decided to transfer the I-16 to *Grupul Vinatoare* (Fighter Group) equipped with IAR-80s for additional air combat training. On 11 September 1941, 1st Lieutenant Ivancovici arrived at Botosani, to ferry the Soviet fighter to Buzau. No problems was encountered during the take off and ferry flight, but on landing at Lasi airfield, the I-16 Type 29 suffered a landing gear failure and was seriously damaged. As a result, the type was scrapped at Lasi and never reached the Fighter Units for air combat training.



This I-16 Type 29 was captured by the Royal Rumanian Air Force and repainted in full Rumanian markings. The White 1 on the fin was used as a kind of serial number for captured aircraft. The aircraft was used to fly mock combat against the squadron's IAR-39s, training the crews in ways to combat the I-16. (Dan Antoniu)



# Two Seat Trainers

## UTI-2 Trainer

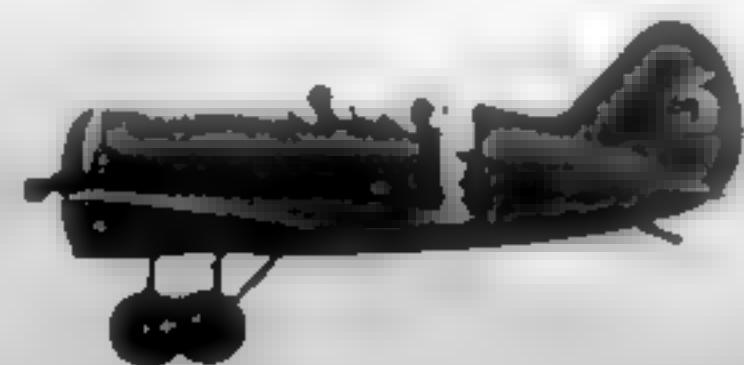
In July of 1935, the I-16 Type 4 fighter was assigned to front-line Fighter Aviation Regiments. Simultaneously it was decided to develop a two seat trainer version of the I-16 to assist pilots in conversion from earlier biplane fighters to the new monoplane. The flight characteristics of the I-16 were demanding and it soon became obvious that novice pilots needed at least a couple of familiarization flights in a training version. When young pilots transitioned from the Polikarpov U-2 biplane directly to the hot monoplane I-16 the attrition rate, especially during take offs and landings was quite high.

During 1936, the first series of UTI-2 (*U-16=Uchebno Trenirovochny Istrebitel*) fighter trainers were produced. The UTI-2 was based on the I-16 Type 4 with a second rear cockpit for the instructor and dual controls. The aircraft was unarmed and was powered by an 480 hp M-22 power plant. UTI-2s were produced in very limited numbers mainly due to the fact that the more powerful M-25 engine had become available.

The introduction of the I-16 had revealed that the Polikarpov U-2 was no longer suited for basic training, since many novice pilots had great difficulty in mastering the I-16 after receiving their initial training in the Polikarpov biplane. As a result a two seat low wing training monoplane, the Yakovlev UT-2, was chosen as the primary trainer and the UT-1 single seat aerobatic trainer, which had flight characteristics close to the I-16, for advanced training. Then fighter pilots would receive their conversion training in the UTI-2 and later UTI-4 before finally progressing to the single seat I-16 fighter.

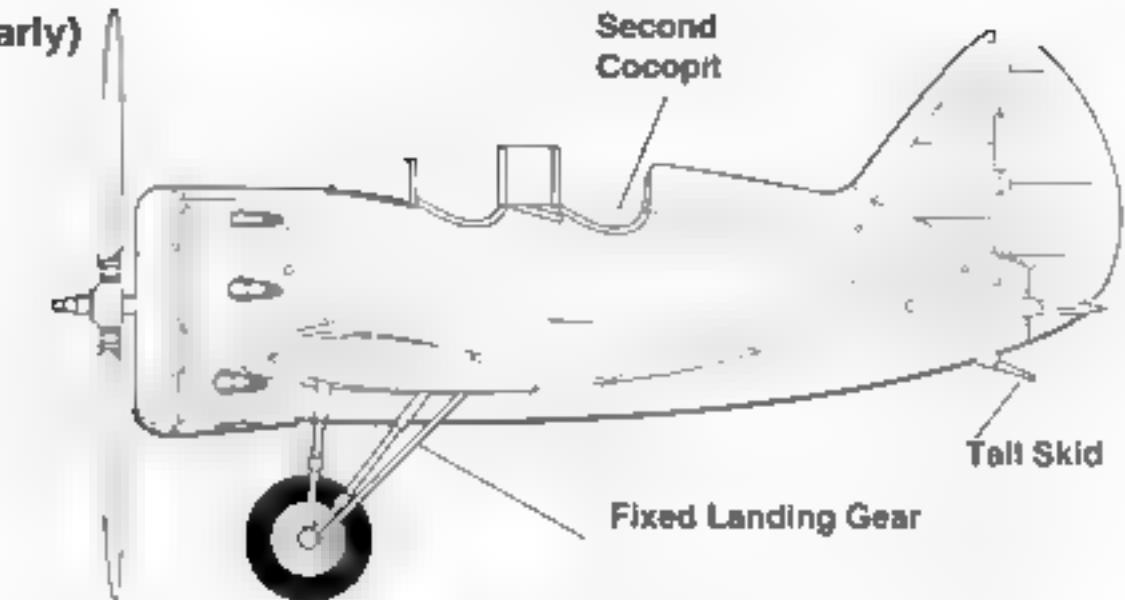
## UTI-4 Trainer

During 1937, the first UTI-4 two seat trainers were delivered to the Fighter Aviation Regiments. Once UTI-4 production was launched, an order was issued by the Ministry of Aviation Production that every fourth airframe on the I-16 production line should be completed as a trainer. The UTI-4 differed from the earlier UTI-2 in that it was based on the I-16 Type 5 airframe with a M-25 power plant.

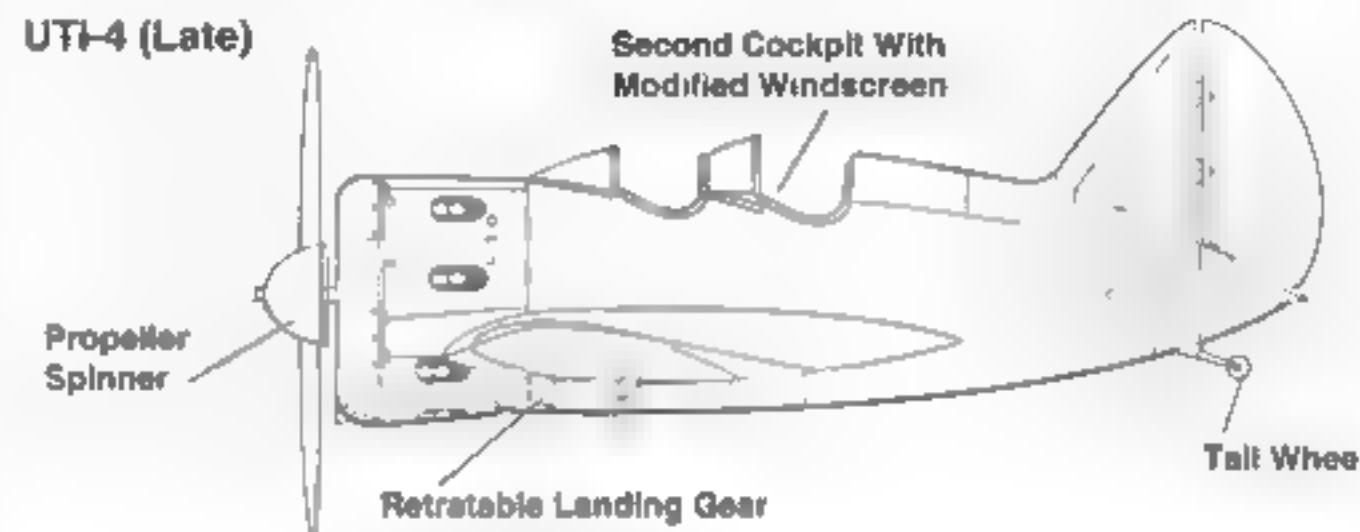


## Trainer Development

UTI-4 (Early)



UTI-4 (Late)



ed as a trainer. The UTI-4 differed from the earlier UTI-2 in that it was based on the I-16 Type 5 airframe with a M-25 power plant.

The UTI-4, like the earlier UTI-2, carried no armament in order to save weight due to the introduction of the second cockpit. Normally, the instructor would occupy the rear cockpit while the student usually occupied the front cockpit. The standard cockpit was moved to the rear some seventeen inches (45 cm) and the fuel tank was recontoured and reduced in size to enable the second cockpit to be installed in the fuselage.

The cockpit entry door was deleted on the UTI-4. While the fighter had a straight cockpit A new flatter single piece windscreens was installed in front of the front cockpit and a second smaller 'tunnel shaped' windshield was installed between the front and the rear cockpits.

Early UTI-4s were all fitted with the M-25 power plant, but when the M-25A became available, it was also installed in the UTI-4. A number of early UTI-4s also lacked a propeller spinner however this was not an identification feature, since a number of early UTI-4s did carry a spinner.

Early UTI-4s had a tunnel shaped rear windscreens but in order to improve the view out the front from the rear cockpit the padded head rest in the front cockpit was lowered and a flatter

sloped frameless windshield was fitted on later production versions.

The two seat fighter-trainer was progressively developed along side the fighter series. The only exception was that the UTI-4 retained the large wing flaps, which were standard to the early fighter versions I-16 Type 5 and I-16 Type 6, throughout its production life. As production proceeded, most of the improvements introduced on the fighters were also automatically introduced on the trainer, such as improved instrumentation and cable cutter for the main undercarriage.

When the I-16 Type 10 became available with its M-25V power plant, this same engine was also fitted to the UTI-4. The first UTI-4 with the new engine left the production line at GAZ-21 and GAZ-153 during 1938. These M-25V powered trainers had also a T-shaped air intake on the lower engine cowl lip. While the early UTI-4 had a single exhaust stack in the lower exhaust port, M-25V powered UTI-4 had two exhaust stacks in the lower port. Most of the standard production UTI-4s powered by the M-25V engine were equipped with an I-16 Type 5 propeller spinner.

A number of UTI-4s were fitted with a fixed undercarriage and, as a result, no landing gear strut and wheel covers were installed.

Late production UTI-4s had the tailskid replaced by a tailwheel. Due to shortage of trainer versions of modern fighters, such as the Yak-1 and the LaGG-3, the UTI-4 also served as a transition trainer for young pilots slated to fly these fighters. In the early stage of the Great Patriotic War, the UTI-4 also served in the reconnaissance role over the front. A number of UTI-4s were also assigned to Fighter Aviation Regiments at the front for liaison duties. Even in 1944, when all I-16 had been withdrawn from active duty, the UTI-4 soldiered on.

A number of UTI-4s were also converted with fixed ski landing gear. As a result the main wheel covers were deleted and cables were attached to front and rear of the skis to keep them from moving in flight. A small ski was also attached to the tailskid.

The UTI-4 also saw service as a blind flying trainer. Initially a fabric, folding tent was installed in the rear cockpit which was closed just before take off. Other UTI-4s converted for this duty were fitted with a rear sliding plywood hood. Some UTI-4s were also equipped with a rudder trim tab and some late production UTI-4s were fitted with a tailwheel replacing the tailskid. UTI-4s serving in the blind flying training role were still in use during 1943.

Between 1937 and mid-1939, a total of 1,639 UTI-2 and UTI-4 trainers were built at GAZ-21. This UTI-4 was used as a blind flying trainer during 1943. The rear canopy is covered by a rear sliding plywood hood. The rudder trim tab is a non-standard fitting. (G. F. Petrov)



This colorful UTI-4 served as a trainer with the 2nd Guards Fighter Aviation Regiment in the Murmansk area in the Summer of 1942. The aircraft carried the Red star on the fuselage, fin and both upper and lower wing surfaces. (G. F. Petrov)

GAZ-153 and GAZ-458 (which solely produced UTI-4s). UTI-4s, which during the final stages of their use, were prohibited from performing aerobatics, carried either a White Cyrillic 'N' or a White band on the fuselage to plainly identify them as restricted use aircraft.

## Spanish UTI-4

UTI-4s were delivered to Spain with the aim to converting non-Soviet personnel to the I-16. In contrast to the biplane I-15, the flying characteristics of the I-16 were, as the Spanish and foreign pilots quickly found out, far more demanding. On 8 July 1937, four UTI-4 two-seat trainers arrived in Spain aboard the freighter CABO SANTO TOME. These trainers were among the first UTI-4s produced in the Soviet Union. They were all equipped with the M-25 power plant and were the only trainers delivered to Spain during the civil war.

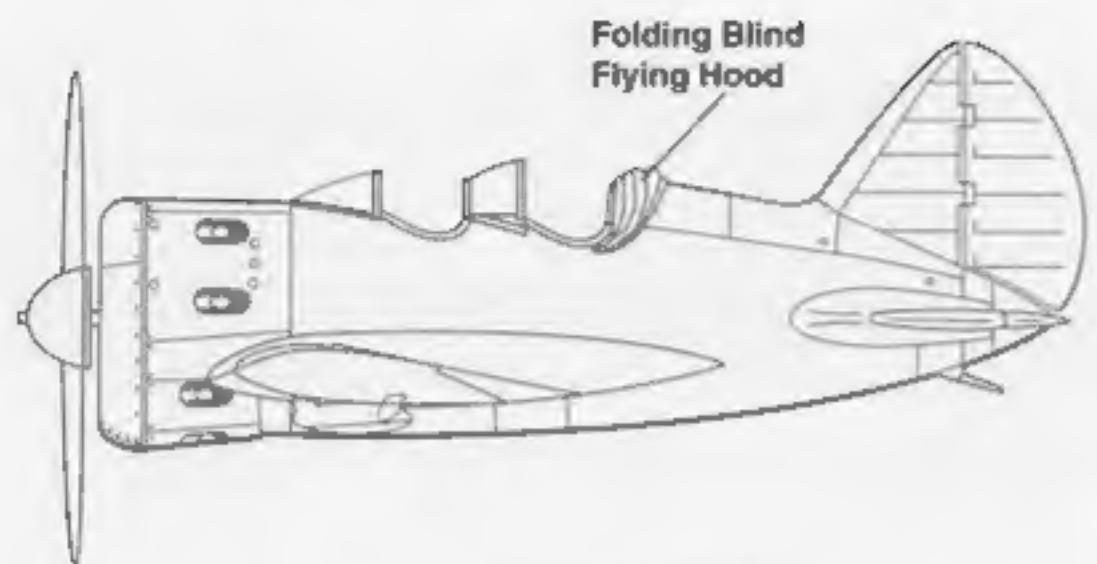
Most of the training bases of the *Fuerza Aerea Republicana* (FARE) were located in the province of Murcia in South-Eastern Spain. All four UTI-4s were allocated to the high speed fighter training camp at El Carmoli near Cartagena. This unit was supplemented by a number of older I-16 Type 5s and I-16 Type 6s single seat fighters.

A group of Spanish pilots pose with one of four early production UTI-4s delivered to Spain at El Carmoli Airfield during 1938. (Juan Arreaz Cerdá)



## Blind Flying UTIs

UTI-4  
Instrument  
Trainer Early



UTI-4  
Instrument  
Trainer Late



At the end of the civil war, a number of these UTI-4s were captured by Nationalist forces.

## Chinese Jung-28A

During 1938, a limited number of UTI-4s were delivered to China to serve in the advanced training role for pilots converting from the Yakovlev UT-1 to the single seat I-16. These UTI-4s were all late production models with a tailwheel and powered by a M-25V engine. The UTI-4s were all allocated to the Air Force Academy at Kunming. Later, in the Summer 1939, when a Russian-style Instruction School was established at I-ning, most of the UTI-4s were transferred to this location, along with four Yakovlev UT-1s.

Beside supplying a large variety of aircraft, the Soviet Union also supported China in establishing an aviation industry. As early as in 1924, the Chinese Communist Party, in cooperation with the Kuomintang headed by Dr. Sun Yatsen and supported by the Soviet government, set up the Huangpu Military Academy and a military aircraft school. A number of students were sent to the Soviet Union for instruction.

During 1940, the Second Aircraft Manufacturing Factory of the Chinese Air Force at Nanchuan, Sichuan Province, started license production of the UTI-4 under the designation Jung-28A. The Chinese copy of the UTI-4 was identical to the late production versions of the original Soviet trainer.



A line-up of Chinese-built Jung-28A trainers. The Jung-28A was identical to the late production UTI-4. The second aircraft in line carries the tactical number, Yellow 31, on the fuselage under the rear cockpit. (San Diego Aerospace Museum, via Ray Wagner)

Once the United States began supplying, under Lend-Lease, sufficient numbers of North American NA-16 and AT-6 advanced trainers to satisfy the needs of the Chinese Air Force, production of the obsolete Jung-28A trainer was phased out in 1943.

## Finnish UTI-4

During the Continuation War with the Soviet Union, a single UTI-4 was captured by the Finnish Air Force on 8 September 1941, in the river Svir area. It was found with a damaged V-25 propeller and spinner parked on its wooden hardstand.

The Finns painted large Finish Air Force markings on both surfaces of the wings as well as on the fuselage. A Yellow fuselage band was added, the identification marking for Axis aircraft participating in combat in the East. During operations with the Finnish Air Force the hinged wheel covers on the main wheel doors were removed, and the propeller spinner was

This UTI-4 originally was serialized VH-22. This was changed on 28 November 1941 to UT-1. The captured UTI-4 logged a total of forty-three hours, twenty-three minutes while with the Finnish Air Force. (Keski-Suomen Ilmailumuseo via Hannu Valtonen)





This Luftwaffe UTI-4 Black DM+HD crashed near Rechlin, however, the pilot survived. The tailwheel identifies this as a late production UTI-4. Wolfgang Tamme) deleted.

Initially the Finnish Air Force serial, Black VH-22, was carried on the fuselage. On 28 November 1941, this was changed to Black UT-1. On 10 April 1942, the aircraft was delivered to the *Lentolaivue 48* and on 8 August 1942, the UTI-4 was transferred to *Täydennyslentolaivue 35*, a replenishment squadron. Shortly after this transfer, the trainer was struck off charge and placed in storage (11 September 1942). During its operational service with the Finnish Air Force, the UTI-4 logged a total of 43 hours and 23 minutes flying time.

## German UTI-4

Long before Operation Barbarossa was launched, the German Luftwaffe had at least two I-16 fighters to study and evaluate. As a result, the Germans, already knew strengths and weak points of the I-16. On 20 September 1938, an I-16 was evaluated by test pilot Heinrich Beauvais of the E2 Department of the Test and Evaluation Center of the Luftwaffe at Rechlin. It is generally believed that this was an I-16 captured in Spain. A further I-16 Type 18, which was captured by the Finns during the Winter War was transferred to Germany for evaluation during April of 1941.

During the first week of the Great Patriotic War, the Luftwaffe destroyed a total of 4,017 Soviet aircraft in the air and on the ground. During their quick advance into Belorussia, the Ukraine, Lithuania, Latvia and Estonia many aircraft were found intact and fully operational, being abandoned by retreating Soviet personnel.

According Luftwaffe documents, several hundred I-16s and UTI-4s were captured on various Soviet airfields, along with a vast amount of spare parts and replacement engines. Both Japan and Iraq had shown an interest in these captured I-16s and UTI-4s for use by their own Air Forces. Initially, the deal was cleared by the Nazi-government, but later it was postponed and, as a result, no Soviet military equipment was delivered to either Iraq or Japan.

As a result, a number of UTI-4s were allocated to Luftwaffe training units. But the Rata, as both the fighter and trainer were generally referred by the Luftwaffe, was a tricky plane to fly and not without a price. On 15 July 1941, *Unteroffizier* (Corporal) Paul Roth was killed at

Molodezno when his I-16 crashed.

On 30 March 1942, an UTI-4 of Ld.Kdo. 2/12 crash landed at Mannheim-Sandhofen airfield in Southern Germany due to shortage of fuel. A day later, on 31 March 1942, an I-16 (Serial 2335) of Ld.Kdo. 2/VI crashed at Dünnwald near Cologne, killing the pilot *Oberfeldwebel* (M/Sgt) Gustav Koll. Another UTI-4 (Serial 15153128) of Ld.Kdo. 2/12 was severely damaged on 5 May 1942, during a taxi accident. Fuel starvation was the cause of a crash landing of UTI-4 (Serial 15153126) of Ld.Kdo. 2/12 at Frankenthal on 28 May 1942. The crew, pilot *Feldwebel* (Sgt) Heinz Schmitz and engineer *Unteroffizier* (Corporal) Erhard Karsten were both injured. Engine trouble forced down an I-16 (Serial 521722) of Ld.Kdo. 64 at Kiel-Holtenau on 14 June 1942. During landing at Schongau airfield on 25 September 1942, an I-16 (Serial 60121) of Ld.Kdo. 1/7 had the landing gear fail, damaging the aircraft's belly.

## Polish UTI-4

A single I-16 (Serial 521560) assigned to the *I Pulk Lotnictwa Mysliwskiego* (1st Fighter Aviation Regiment) *Warszawa* at Grigorievskoje between March and July of 1944, for use in the liaison role. The aircraft was assigned to the regimental commander. When the *I Pulk Lotnictwa Mysliwskiego* went into combat, the I-16 was abandoned. Although assigned to the Polish Fighter Aviation Regiment, it never carried Polish Air Force markings.

Two UTI-4s were taken into the inventory of the Polish Air Force. The first UTI-4 was assigned to the *15 Samodzielny Zapasowy Pulk Lotniczy* (15th Independent Air Reserve Regiment) in November of 1944, while the second was allocated to the *Techniczna Szkoła Lotnicza* (Polish Air Force Engineering School) at Boernerowo near Warsaw at the end of the war. Both of these aircraft received full Polish markings. The UTI-4 assigned to the *Techniczna Szkoła Lotnicza* remained in an airworthy condition until 1947 and subsequently served as a gate guard in front of the school buildings, until it was scrapped in 1949.

**A Polish UTI-4 at the Techniczna Szkoła Lotnicza (Polish Air Force Engineering School) near Warsaw. The aircraft was used as a static demonstrator between 1945 and 1947. (Marlusz Konarski)**





A ski equipped I-16 Type 10 climbs out after scrambling from its base during an attack by Luftwaffe Ju 88 bombers.



An I-16 Type 24 prepares for another ground attack sortie from a forward airfield. The aircraft is armed with RS-82 air-to-ground rockets and the main landing gear doors have been removed.

ISBN 0-89747-355-8  
90000>



9 780897 473552